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Electrical World

McGraw-Hill Company, Inc.

February 13, 1926

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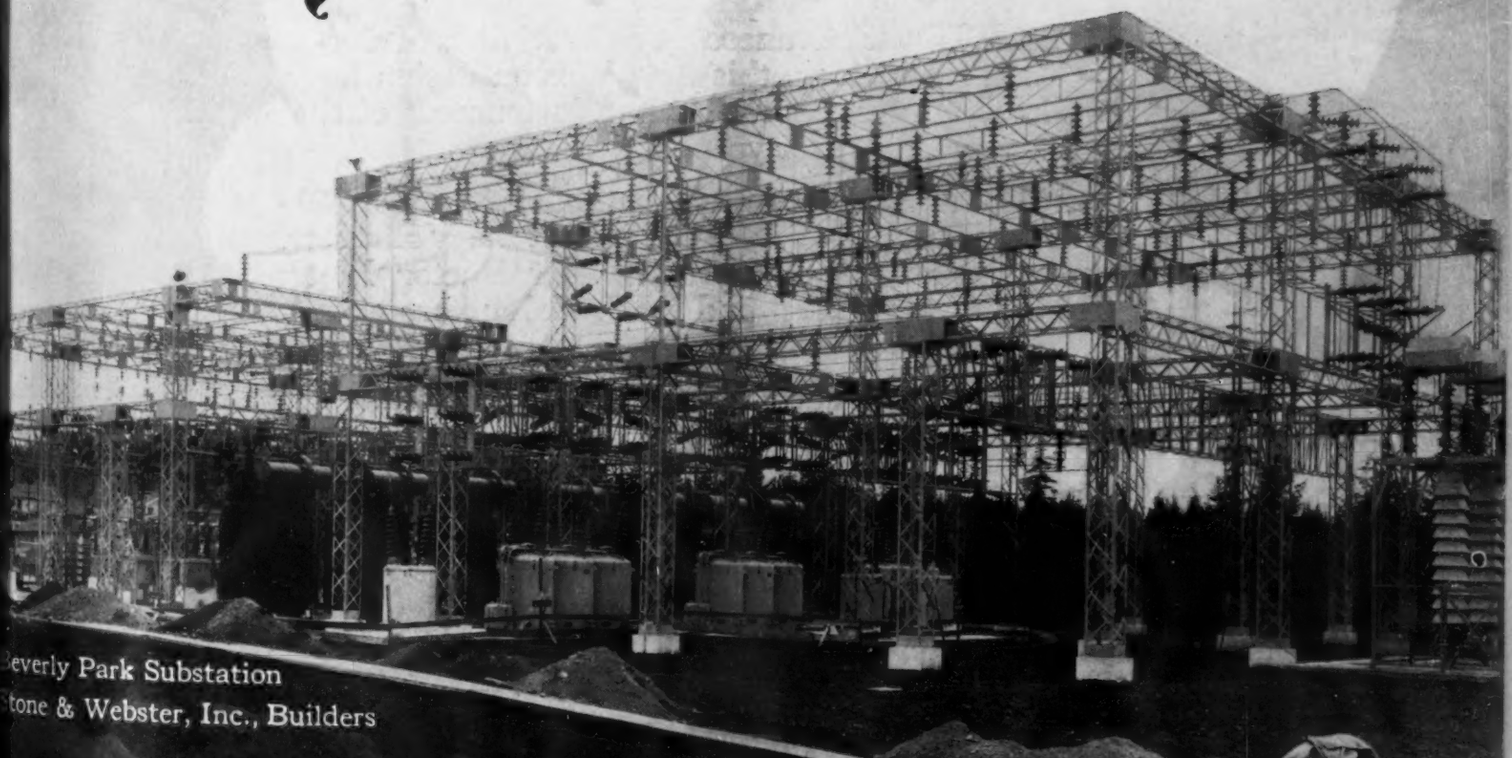

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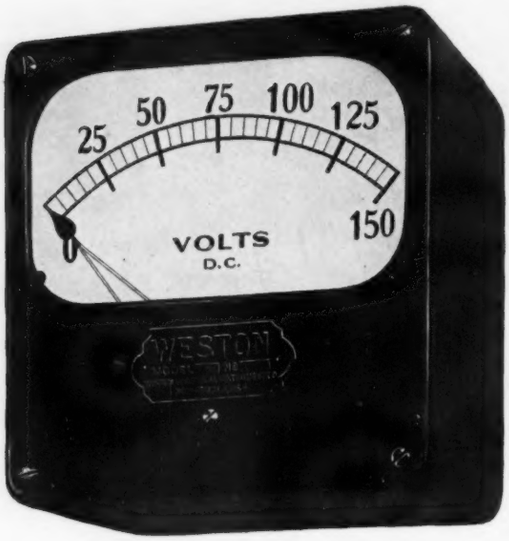

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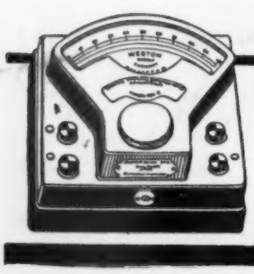

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Electrical World

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W. H. ONKEN, JR.
Editor

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Factors of Strength in Public Utilities

SAMUEL INSULL'S clear-cut and forceful address before the Boston Chamber of Commerce last week on "Public Utilities and the Public" is a timely contribution to the constructive thinking of the industry. The address, abstracted elsewhere in this issue, was prepared for the layman, but Mr. Insull's well-known penchant for significant statement on matters of weight to the electrical industry itself was never more in evidence. Following a masterly review of the economic and social advantages of interconnection, Mr. Insull electrified his audience by vigorous comments upon Prof. William Z. Ripley's article, "From Main Street to Wall Street," in the January *Atlantic Monthly*, which sharply questioned the soundness of holding-company development in the electric light and power field and particularly deprecated the concentration of voting control into a few hands.

This is not the place to repeat Mr. Insull's discussion of the accuracies and inaccuracies of Professor Ripley's article with regard to the approximate billion-dollar investment in public utilities under the former's management. Mr. Insull's record in the utility field speaks for itself. The larger significance of Mr. Insull's remarks is to be found in their virile championship of practical management as distinguished from financial management, in their stanch advocacy of property control by the holder of common stock, in their powerful contention that nothing could have a more chilling effect upon the public utility industry than federal control, and in their warning against speculative domination of operating companies by promoters having no constructive interest in serving the public. By and large, voting control still resides with the holder of common stock, and but a small portion of the fifteen billions of money invested in the total public utility business of the country is involved in the current speculation. If the industry continues to advance imbued by the ideals of service which have founded and sustained its wonderful prosperity in years past, the dangers depicted by Professor Ripley and the practices discountenanced by Mr. Insull will have small power to injure either the investor or the customer, rapidly becoming one and the same person.

A Real Contribution to Knowledge of Stability

SYSTEM stability has been a debatable subject for several years. The advocates of transient stability and those of static stability have argued for their respective criteria for system performance in many papers and meetings. Data on an actual system, however, have been unavailable until lately, and the discussions have waxed warm on the basis of the relative importance different specialists attached to assumed factors.

It is encouraging to find that executives of the Pacific Gas & Electric Company consented to submit the system of that company to a series of stability tests for the benefit of the whole industry. In his paper before the meeting of the American Institute of Electrical Engineers this week Roy Wilkins gave the results of the tests and made available to all properties many valuable data. The executives and engineers of the Pacific Gas & Electric Company have thus contributed greatly to the development of the art, and it is to be hoped that tests by other utilities covering data needed to develop other phases of the art will likewise be published for the benefit of the industry instead of being merely placed on file on dusty shelves.

The normal limit, or even rating, of a power system is difficult to define because of the ever-changing electrical and physical conditions in lines, equipments and loads. For a specific system, however, both the static and transient stability limits can be agreed upon and determined quite accurately for given conditions. Thus progress has been made. Debates on technicalities and attempts to generalize about stability should not be permitted to obscure this fact.

Conowingo Development Assured

THE tangle which has existed for some time in the efforts to develop additional water power from the Susquehanna River at Conowingo, Md., bids fair to be unraveled at an early date. The tangle has been caused largely by the fact that the site of the proposed plant is in the State of Maryland and that the demand for the power and the principal financial support for the project are both to be found in the State of Pennsylvania. In the early stages of the discussion it was also thought that the situation was complicated by the rivalry between certain financial interests. Maryland was interested in retaining her rights to power from the development at such future time as she might need it. At present her demands are well taken care of by the existing plant at Holtwood, Pa., farther up the river, in conjunction with steam plants both at Holtwood and Baltimore. Maryland has also demanded that she be compensated for her state roads and bridges.

Those who were opposing the project for whatever cause criticised the proposed expenditure as unnecessarily great and took the position that it would be impossible to deliver reasonably cheap power in Philadelphia. Questions of this character led to long discussions. The successive phases of the situation have been followed carefully in the news columns of the ELECTRICAL WORLD, which was recently able to record that the Public Service Commission of Pennsylvania and the Public Service Commission of Maryland had both granted permission for the development. These final agreements were reached only after much study and several open hearings before the commissions, in which many complicated problems arising from conflicting interests in the two states were thrashed out. For example, the Maryland commission has required

that such power as is to be distributed in Maryland shall be furnished directly from the power plant and not transmitted into Pennsylvania before distribution. This restriction is made in order to prevent complications of interstate commerce affecting the regulations of the sale of power in Maryland.

One of the principal grounds in support of the project as financed is that the stream flow of the Susquehanna fluctuates widely and can be economically utilized only in conjunction with operating steam plants such as are available only in Philadelphia. It is understood that the Federal Power Commission will issue the necessary license immediately, and all of this action insures a prompt realization of the proposed fifty-two-million-dollar plant near Shure's Landing on the Susquehanna River. The plans call for a dam at Conowingo 86 feet high and more than one-half mile long. The difficulties which this project has encountered, stretching back over several years, suggest the old saying, "You can't keep a good man down." It looks as though much the same thing can be said about a good water-power development.

Minimizing the Effect of Near-Station Short Circuits

SHORT circuits and grounds on feeders within a mile or two of a modern generating station of large capacity tend to put heavy strains upon plant equipment. It is not surprising that a temporary shutdown of service over densely occupied areas occasionally accompanies cable trouble of this kind, and from every point of view it is vitally important to study such failures and seek safeguards against recurrence. Closely related to it is the whole subject of switch-house design, cable and bus protection, sectionalization of feeder groups, location of reactors, if used, and the rating of protective equipment.

Recent experience raises the question whether it may not pay to analyze more thoroughly in future the protective limitations of reactors, the possibilities of more complete isolation of phases and the effect of neutral-point grounding in large station transformer interconnection banks upon short-circuit currents as an aid to rooting out the causes of shutdowns from heavy short circuits and grounds in or near the station. The failure of a feeder reactor at such a time may be very serious. No intention exists of condemning the use of reactors, but it would seem expedient to study all such failures with the utmost care to see that sufficient margin exists to handle short circuits on single feeders more effectively.

As for terminal lugs, it would be helpful to know more about their heating limitations under short-circuit current, and tests to this end will probably be forthcoming as the result of recent failure under stress. It has been suggested that their conductivity may be increased by the use of silver solder rings, either with or without adopting larger sizes of lugs in reactor and switch connections near buses. More complete sealing of thimbles through which operating switch rods may pass in bus structures designed for isolated phase work is also worth considering. More and more the value of very liberal spacing in switch-house design can be seen, and it may be that this, combined with the provision of alternative paths of exit and entrance to sectionalized bus compartments and more rugged equipment, will meet some situations at less expense than will oil circuit breakers of increased capacity and corresponding higher cost. As for neutral-point tie-line transformer-bank grounding, the use of resistances to supplement reactors in limiting the flow of current in cases of phase grounding is receiving favorable consideration, and there is room for some interesting analysis in this field.

Better Motor Drive Data Needed

THE ELECTRICAL WORLD has lately had occasion to survey motor drives in a number of industrial plants in connection with the reviving interest of the industry in individual versus group installations. A surprising number of these factories maintain only the barest inventory records of their motors. Some plants keep up a fairly good card index of motors, control and driven machinery, but the proportion which can produce an accurate and complete record of the drives themselves is small indeed. From the point of view of the plant owner this is natural enough. His interest in motors is intrinsically tepid; they are mere auxiliaries of his work, and so long as they cause no trouble, why should he devote any thought to them? He is not to be blamed by the electrical editor, whose appetite for engineering data grows with its satisfaction; but, after all, there exists what might be called a shorter and a longer catechism of motor users in the interest of the highest economic service. Whether the plant owner realizes it or not, these are days of keen analysis by leading engineers of all sorts of actual and potential wastes in the electrical as well as other industries. The world is still in a transition period which began with the war, and as time passes inefficiencies are sure to be challenged more and more sharply, regardless of where preventable losses are found. It should need little demonstration to prove that periodical check-ups of motor-drive conditions are among the best possible means of diagnosing industrial power ills and related wastes, besides furnishing suggestive information upon operating costs and capital investment competence in the power application field.

The shorter catechism referred to contains the minimum of motor-drive information useful to the engineer. It covers the name, make and rating or size of the driven machine, the type of drive, make, type and rating of motor, including its speed. This minimum of data is too often missing and when needed has to be obtained and sometimes expanded under pressure into the longer category of queries which must be answered if involved problems are to be solved intelligently in the fascinating field of motorization. These latter may include pinion, pulley, gearing and belt data, measurements of shafting, sketches, photographs and drawings to scale of motor mountings, layouts in relation to machinery driven, test information, lists of part numbers for ordering, inventories of spares and of material in stock, detailed control data, references to specifications, purchasing department information, historic data and maintenance records with wiring diagrams. Consulting engineers who design motor layouts will do well to follow more closely their "life stories" than has formerly been general practice. Changes in applications are almost inevitable in the majority of plants because conditions are bound to alter. The cost of procuring and of maintaining much more scientific data than are commonly available on motor drives is fortunately small, and work along this line helps to reduce misapplications, overmotoring and unprofessional guesswork.

False Economy Retards Industrial Electric Heating Processes

IN MANUFACTURING processes involving heat treatment of metals the actual cost of heat is surprisingly small no matter whether electricity or some form of fuel is used. Seldom does this item exceed 1 per cent, and frequently it is as little as one-fifth of 1 per cent of the total cost of the finished product. Yet in the face of this condition industrialists hesitate to use electricity for their heating processes and electric heating engineers are constantly confronted with competition from other fuels upon a price basis alone. As a matter of fact, this should be the last consideration by a manufacturing concern interested in improving either quality or working conditions in its plant.

It is encouraging, therefore, and indicative of an enlightened attitude on the part of potential users, when at a meeting of industrial engineers the virtues of electric heating are expounded by one of their own men. It was pointed out that in the heat treatment of steel or other metals a manufacturer is warranted in adopting anything that will reduce the amount of labor, lessen the number of rejected pieces, improve quality or improve working conditions. Electricity is the only form of heat which combines these four important requirements. In the matter of cost erroneous ideas as to expense are hindering its more rapid adoption and working against the best interests of the manufacturers themselves. With the relative cost of heat so low when compared with total manufacturing costs, an industrial plant can well afford to spend from one to five times as much for electricity as for some other form of heat, or even more, and still be money ahead. It is sometimes even possible by direct application of electric heat actually to lower the cost of heat-treating. False ideas of economy in the matter of fuel can very easily cost an industrial plant a much larger sum in excessive labor, spoilage, poor quality and discomfort for its workmen than would be represented by any added cost for the use of electrical energy.

Insulator Testing Pays Good Returns

WITH the ever-increasing distances over which power is being transmitted and distributed, the vital problem facing the operating companies is continuity of service—not service virtually all the time, but 100 per cent service. Such service is dependent upon a number of factors, one of the most important being the insulator. Very favorable progress has been made in the manufacture of these articles, but even the best porcelain insulators may depreciate with age or under mechanical and electrical stresses and repeated temperature changes. Periodic inspections and tests should detect faulty insulators before they fail and interfere with the continuity of transmission. There are now several devices for safely locating these defective insulators on live lines.

It is interesting to note the experiences of one large utility company in the class producing a billion kilowatt-hours a year. This company has about a million high-tension insulators on its lines. Seven years or so ago a live-line method of insulator testing was adopted, and during the first year between 25 per cent and 30 per cent of the insulators then on the lines were found to be defective on test and were subsequently changed. In the year following this percentage dropped to below 5 per cent. During the year just past out of nearly half a million suspension insulators the proportion of defective ones was a little over three-tenths of 1 per cent. No one can tell just how many interruptions from the 1,700 faulty insulators removed would have occurred had they remained in service, but as lightning conditions are rather severe in the territory concerned the chances are that a majority of them would have failed.

Interruptions are costly—to service, for repairs and maintenance, and to good public relations. By eradicating the source of trouble undesirable happenings can be prevented. The company referred to above found that to do this properly cost but one and one-half cents per insulator per year. One or two failures might easily cost as much as the total amount of money spent for insulator testing in one year. This company has found that a systematic periodic testing of every insulator on its lines pays dividends in dollars and service.

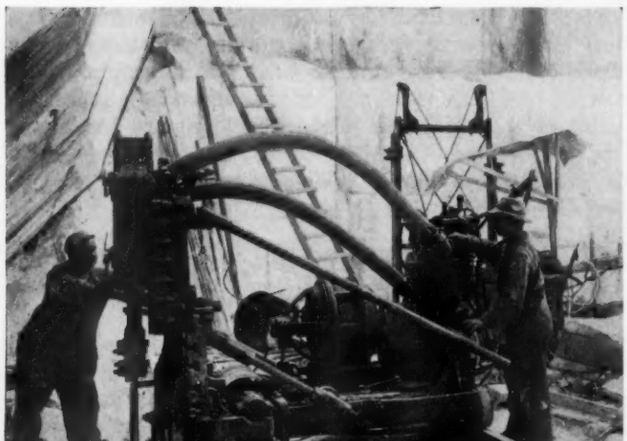
Uniform Rates as Aids to Public Relations

WHEN one goes into a grocery store to purchase a can of tomatoes and inquires the price, one expects to hear it quoted as "so much" a can. Many people ask why it is not possible to charge for electric service on a similar basis. The men of the industry know the answer, but have they appreciated the confusion that arises in the minds of customers because of fantastic rate forms, to say nothing of the wide variation in the net rates for electric service throughout the country?

It should be self-evident that some companies will be able to serve a given class of load at lower cost than others. Why should it not be possible, however, for the industry as a whole to establish certain fundamental rate forms, so that people in Oshkosh or Kalamazoo would become familiar with the same formula for calculating their bills for electric service that is in use in New York or San Francisco? There is probably no single factor of more fundamental influence upon public relations than the character of the rate forms in use. The thing which even informed citizens fail to understand is the great variation in the formulas used to arrive at a bill for service rendered. In one case a simple charge of, say, 10 cents per kilowatt-hour may be used, whereas in the state where the customer so charged resided previously it may have been necessary to count the number of rooms, the number of outlets, perhaps the number of children in the family and the number of servants to find the sum owed.

These cases are extremes, but somewhere between extreme simplicity and extreme complexity there should be a compromise which would reasonably meet the conditions of the country as a whole and would establish a form of rate, and therefore a form of bill calculation, with which people in the entire country would soon become familiar. Much of the suspicion with which electric rates are now sometimes viewed would immediately disappear as soon as it was learned that bills were calculated by the same formula in every portion of the country. Here is a monumental task, but one the accomplishment of which would bring far-reaching benefit to the industry. The apprehension is always present that unless the industry solves its own problem in this regard some legislative representative of the "great common people" will undertake to lead them out of the wilderness.

Individual Motor Drive Making Headway in the Marble Industry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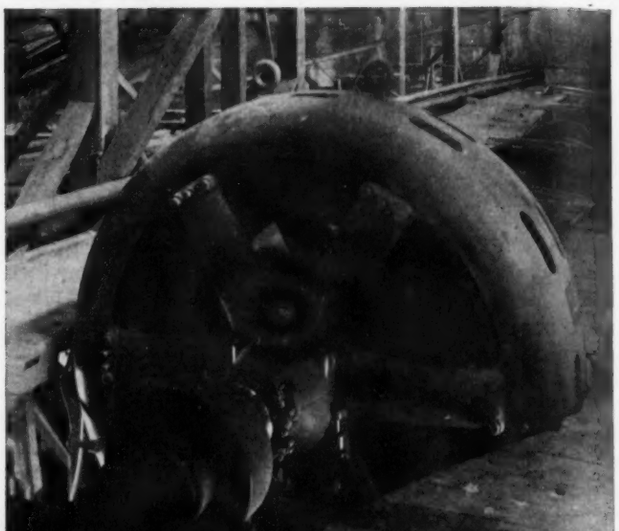
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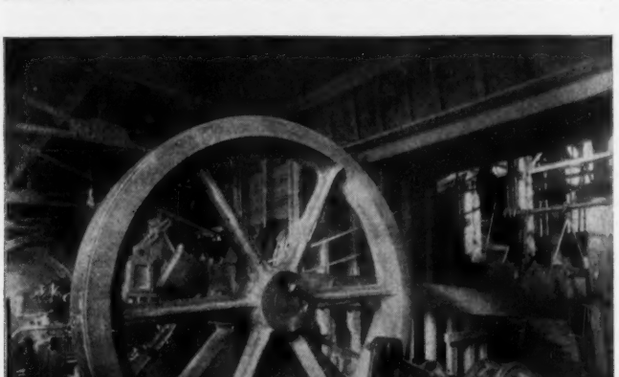
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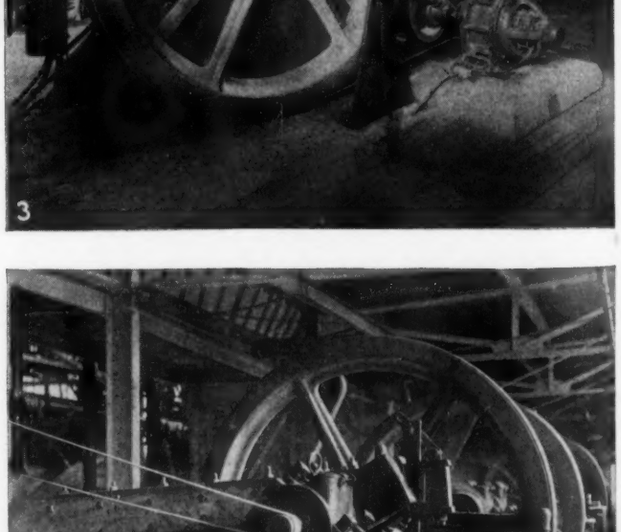
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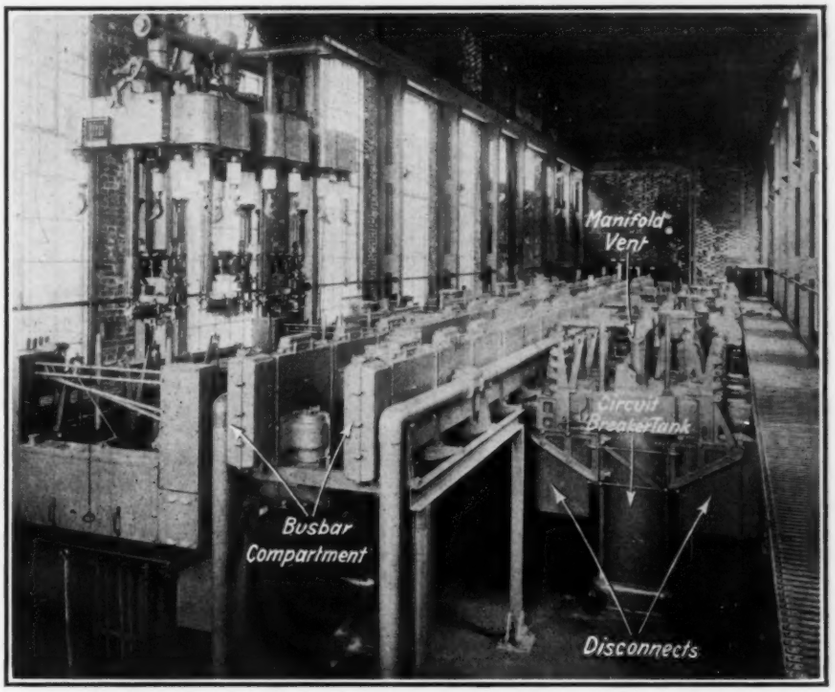
REPEAT orders furnish the best proof of successful applications of electricity to industries, and in the new mill of the Vermont Marble Company at West Rutland the type of individual motor drive illustrated here is certain to duplicate the good results already obtained in the plant. Motor-driven compressed-air channeling machines (Fig. 1) are speeding up production in the quarries, and in the sawing mill the old 250-hp. 36-gang design of group drive (Fig. 2) has been superseded by the individual motor application (Figs. 3 and 4).

The elimination of the old line shaft in the latest gang-saw drive cuts down the cost of building construction, enables sections of the mill to be shut down without disturbing production all along the line, utilizes power only when work is being done and simplifies the mechanical layout. Twenty-four gang saws in the new mill will duplicate the installation design shown in Figs. 3 and 4. Each gang saw is driven by a 10-hp., 440-volt, three-phase slip-ring-type induction motor, and as many as eighty saws are sometimes operated per gang, the average being twenty. A flywheel type of pulley is used, and each pair of gangs is provided with a 3-hp. motor for raising the saws and another of the same rating for pumping sand and water.

What Is Reyrolle Switchgear?

Just Introduced Here but Old Abroad—Self-Contained and Foolproof—Saves Building Space and Cell Structures—Easy to Install, Inspect and Maintain—How Advantages Are Obtained

ARMORED switchgear which is radically different from anything now used in this country, but which nevertheless has become quite a favorite particularly in Great Britain and continental Europe during the last twenty years, is now available for operating companies in the United States through the Allis-Chalmers Manufacturing Company. The switchgear is known as the Reyrolle gear. As intimated, experience with the switchgear is not lacking. A survey made by the British manufacturers last year indicated that 65 per cent of all power used in Great Britain was controlled by Reyrolle gear. Furthermore, out of six of the superpower stations recently built or building there, five are using the switchgear. Considerable interest has also been shown in it by American engineers who have seen or heard about the equipment.



BUSBAR COMPARTMENTS, CIRCUIT BREAKER MECHANISM, DISCONNECT TANKS AND MANIFOLD VENT OF BARKING STATION (ENGLAND) SWITCHGEAR. MADE IN 800/3,000-AMP., 6,600/33,000-VOLT SIZES UP TO 2,000,000 KVA. CAPACITY

Among its features which will be discussed more in detail later are reliability, safety, self-contained nature, compactness, avoidance of cell structures and ease of installation, additions, replacements, inspection and maintenance. It will be made available in several different types up to ratings of 3,000 amp., 33,000 volt and 1,500,000 kva. rupturing capacity. The cost of the Reyrolle switchgear cannot be directly compared with customary oil circuit breakers, because the armored switchgear includes in one unit the busbars, cable potheads, shunt and series transformers, disconnects, circuit breakers and auxiliaries, thus necessitating less building space and structural expense than would be required if the components were installed in the customary cell structures. It is claimed by the English manufacturer that up to 20 per cent in total cost of installation, including building, has been saved by this switchgear compared with American construction.

Indicating the interest already shown in the switchgear in the United States, at least four utility companies have placed very substantial orders therefor. Among the orders are included every type in which this switchgear is now made. One of the orders includes 47 units rated at 13,000 volts in sizes up to 400,000 kva. rupturing capacity. Another order involves five 3,000-amp., 12,000-volt units for controlling the output of some 60,000-kva. turbo-generators and two 500-amp., 12,000-volt units for feeders.

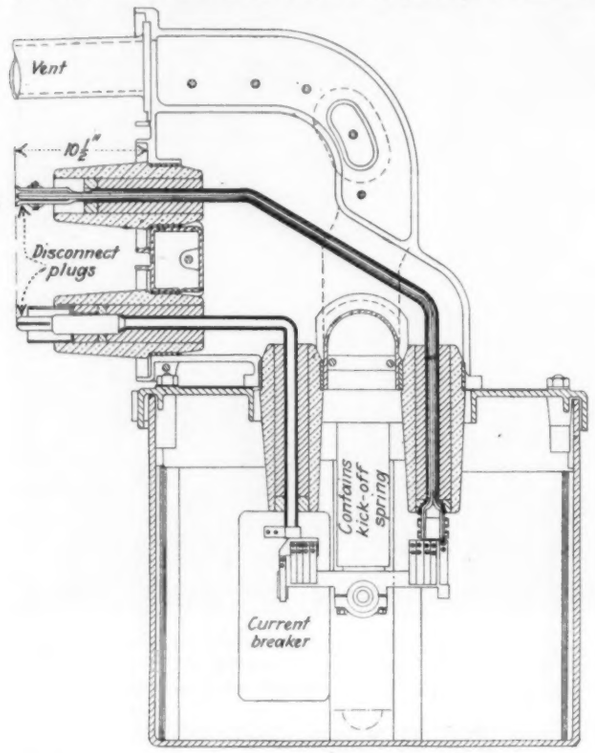
As opportunities and facilities are made available in this country, the various types and sizes of switches will be tested to destruction for the information such investigation discloses and to check ratings based on design or experiences in Europe. At the same time tests will be made to ascertain the speed of rupturing circuits carrying various loads. Meanwhile the British ratings are being modified to conform with American ratings, which take into account different numbers of successive operations and the frequency thereof. It may be of interest that one of the representatives of the British company declared that the switch tanks have been subjected to an impulse pressure of 5,000 lb. per square inch abroad without any evidence of distress. Although not designed for outdoor use, some units have been in outdoor service abroad for several years.

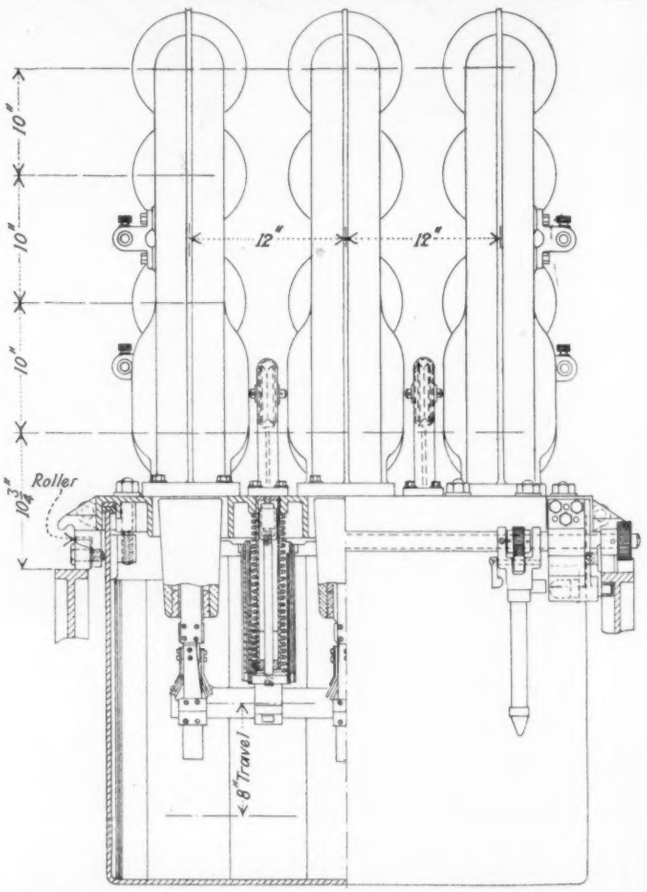
How Advantages Are Obtained

Means of protecting life, property and continuity of service have to be considered at one time, because what is provided to protect one of these elements usually protects the others. Statements can be made regarding how such protection is afforded, but a reader can judge this for himself if the construction is explained. As previously mentioned, each unit comprises within itself the busbars, cable potheads, shunt and series transformers, disconnects, circuit breakers and auxiliaries. These components are segregated and arranged in two groups. One group is fixed and incorporates the busbars, transformers, cable-dividing box and supporting framework. The other group is removable and includes

the series-type transformers and circuit breaker with the necessary operating mechanism. By racking out the movable portion from the fixed portion, which is an easy operation, all parts to which attention is frequently given can be safely inspected or worked upon.

In general all conductors involved in the switchgear besides being adequately insulated are inclosed in grounded metal housings and the intervening space filled with compound or oil. Thus it is impossible for anyone to come accidentally in contact with or within arcing distance of any conductor. Simple but positive interlocks make the equipment almost foolproof. Being self-contained and metal clad throughout, no cell structures are needed for any of the equipment involved in switching. The compactness of the unit makes much less space necessary than is usually required for all of the equipment necessary for switching operations. Also, because it comes as a self-contained unit, it can be installed easily. Practically the only preparation needed for it involves running in feeder cable and control conduit to the switch location. After the switchgear is moved into position on the floor, adjacent bus sections are joined and the joint housing is secured in place and filled with hard compound. The cables are simply connected, as will be explained later. Additions to switchgears can be easily made by merely setting up another unit, as previously explained. Being built for jig production all equipments of the same ratings and their parts are interchangeable. If one circuit breaker should become inoperative, it can be racked out and substituted by another by means of a truck carrier.





SPACE REQUIREMENTS OF ARMORED SWITCHGEAR FOR A SPECIFIC INSTALLATION

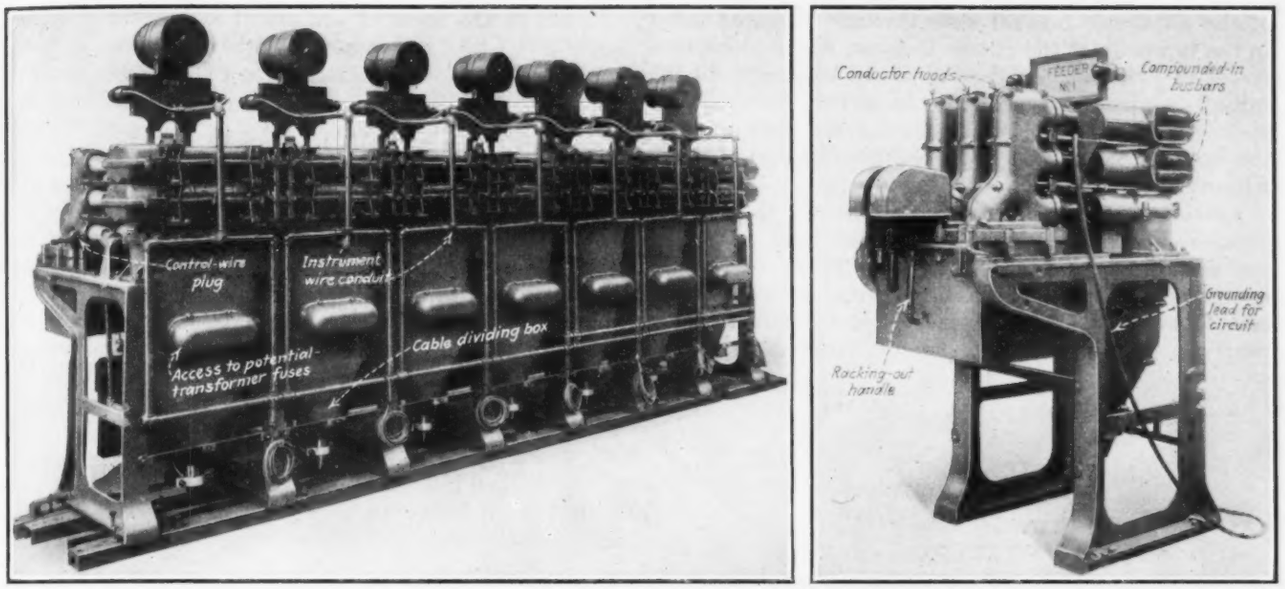
Left—Breaker. Right—Draw-out portion of switch

Depending on the type, the construction of the circuit breakers differs in some ways, but the general principle is explained by the following description of one type.

Cable-Dividing Box or Pothead.—The main cables leading to or from the switchgear terminate in a metal dividing box bolted to the under side of the unit. Brass universal glands are attached to the bottom of the dividing box to which the cable sheaths may be secured by a plumbed joint. Clamps are also supplied to terminate cable armoring when such is used. Inside the dividing box, which is split vertically to permit ready access, the individual conductors of the cable or cables are separated and attached to insulated conductors extending vertically through the chamber above, which accommodates the series transformers. After terminating the cable, the split casing of the dividing box is replaced and filled with solid compound. This is one of the few operations that must be performed when the switchgear is installed.

Transformer Chamber.—Directly above the cable-dividing box is the transformer chamber, through the center of which in a vertical direction run the insulated conductors connected with the cable terminals below. The upper ends of these conductors terminate at disconnecting sockets housed in deeply recessed orifice bushings. The series or current transformers are mounted in the transformer chamber, which is filled with compound.

When a potential or shunt transformer is required, it is mounted in front of the series transformer chamber and housed in an oil-filled metal case. Primary connections to the potential transformers are made by means of plug type dust-filled fuses inclosed in separate horizontal receptacles, from which they may be withdrawn for replacement after removing a metal cap at the front of the switchgear. These fuses are connected with the cable side of the switchgear and their removal entirely isolates the shunt or potential transformers from the system.

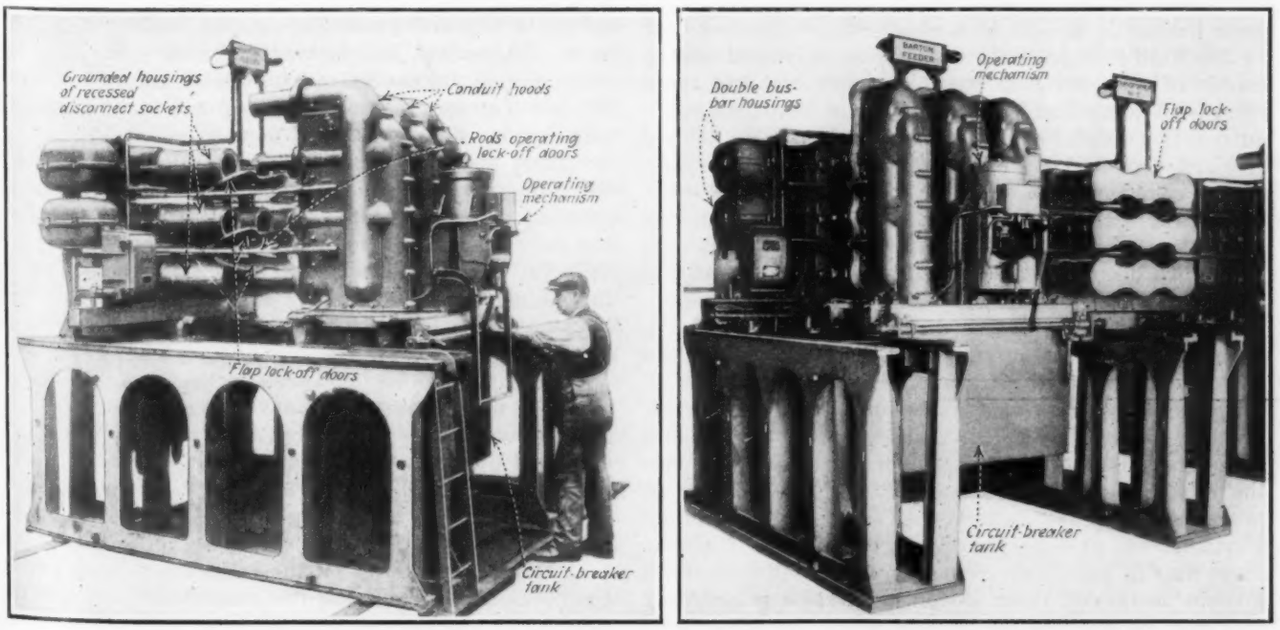


THE UNITS ARE MADE IN 300/600-AMP., 3,300/12,000-VOLT SIZES UP TO 150,000 KVA. RUPTURING CAPACITY. VIEW SHOWS COMPOUNDED-IN BUSBARS, GROUNDING LEAD, RACKING-OUT HANDLE, CONTROL-WIRE PLUG, INSTRUMENT-WIRE CONDUIT AND ACCESS TO POTENTIAL TRANSFORMERS. FRONT AND REAR VIEWS

Circuit Breaker.—Directly in front of the series transformer chamber and forming a part of the removable portion of the switchgear is the oil circuit breaker itself. The circuit breaker is housed in a heavy welded-steel tank supported from a cast-steel top plate. The tank and cover are made sufficiently strong and the head of oil and speed of opening adequately high so that, without explosion chambers or their counterpart, they will withstand the impulse pressures that will be exerted at the rupturing capacities for which the switchgear is rated according to the manufacturers. Baffled vents are provided to relieve the internal stresses gradually on the larger switches. All circuit breakers have at least two breaks in series. The larger capacity breakers have a third break situated away from the others, all of them drawing the arc in a horizontal direction. The tanks may be readily dropped for switch contact inspection and the operating mechanism removed, if desired.

Above the top plate of the switch tank are three hoods through which the main conductors pass from the fixed contacts in the tank to plug disconnects (like those already described). One set engages with the outgoing or incoming cable socket disconnects and the other set with the busbars. The hoods housing these conductors are filled with solid compound.

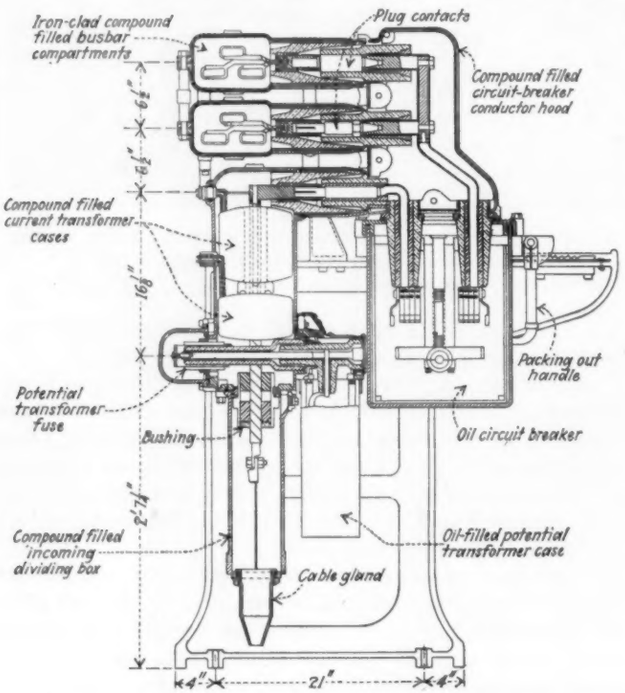
Operating Mechanism. — The operating mechanism forms a complete unit and is mounted on the top plate of the circuit breaker, the electrical control connections being made through secondary socket-and-plug disconnects attached to the fixed and removable portions of the switchgear respectively. The coupling members between the operating mechanism and movable contacts



RECESSED DISCONNECT SOCKETS, FLAP DOORS AND OPERATING RODS, DOUBLE BUSBAR HOUSINGS AND CIRCUIT BREAKER MECHANISM ARE ILLUSTRATED. MADE IN 1,500/3,000 AMP., 6,600/33,000 VOLT SIZES UP TO 1,000,000 KVA. RUPTURING CAPACITY

of the oil circuit breaker slide through insulated tubes in the top plate of the circuit breaker, which also house powerful "kick-off" springs employed to accelerate the initial opening movement of the switch contact. Oil dashpots come into operation during the final stage of the opening travel and bring the moving parts to rest without injurious mechanical shock.

Busbars. — Back of the hoods above the circuit breakers and constituting a part of the fixed portion of the switchgear are the busbars. These consist of laminated copper, and, besides being adequately insulated, are solidly compounded inside a grounded metal chamber. In the low-voltage circuit breakers each complete busbar is housed in a single metal chamber, but in the high-voltage units each phase is placed in the center of an individual metal chamber and the space filled with compound. Where duplicate busbars are required, two similar chambers are provided. Mechanical stresses produced in the busbar assembly by short-circuit conditions are offset by insulating separators.



CROSS-SECTION OF ONE TYPE OF REYROLLE SWITCHGEAR, INDICATING GENERAL PRINCIPLE

Integral with the busbar chamber are three tubular projections which house the main disconnecting sockets. These are deeply recessed in orifice bushings and are connected to the busbars by laminated copper strip.

Locking-Off Doors.—The metal orifices inclosing the bushed and recessed sockets of the fixed portion of the switchgear are fitted with automatic doors arranged to cover the openings completely when the oil circuit breaker is racked out. On replacement of the breaker for operation the doors open automatically and fold into the space between the chambers. This arrangement prevents accidental contact with any live conductors. Furthermore, padlock plates are provided so that the doors may be positively secured in the closed position to prevent accidental reconnection of circuits in case any men may be working on it.

Bus Selector.—Simple and effective means are provided for enabling connection of the oil circuit breakers to either set of duplicate buses (when such are employed) in the form of one set of removable plug contacts which may be inserted in either the upper or lower group of bus sockets attached to the movable portion. As an alternative, oil-immersed selector switches can be used instead of plugs.

Framework.—The fixed and removable portions of the switchgear are separately carried on two massive side frames. The upper faces of the fixed standards are machined to serve as a runway for rollers carrying the circuit breaker. Easy movement of the breaker for disconnecting purposes is secured by means of a hand lever attached to the top plate and operating a ratchet wheel that engages with a rack on the fixed framework.

Instruments and Relays.—When it is desired to accommodate instruments and relays on the switchgear unit, an instrument bracket and a swinging relay frame are provided. The former is carried above the busbar assembly and the latter is attached to the main frame standard below the oil breaker. Both instruments and relays are back connected and the terminals are protected by sheet-metal covers. The swing feature of the relay frame affords easy access to the wiring.

Secondary Wiring.—All external secondary wiring for metering, protective and control circuits is inclosed in metallic tubing. Where a separate control panel is employed, the secondary circuits are carried in a multiconductor cable. To house this at the panel end, a dividing box is attached to the frame standard. The terminal board is protected by a sheet-metal cover.

Manufacture.—All portions of the switchgear are assembled in the factory in jigs built to a high degree of accuracy, insuring efficient interchangeability of parts. Furthermore, all of the chambers which were referred to as being oil filled or compound filled, with the exception of the cable-dividing box, are filled at the factory.

Interlocking.—A very complete though simple system of interlocking is used, making it impossible without mechanical interference to obtain access to any conductor except when it is de-energized. The interlocking features eliminate the possibility of careless operation and insure the correct sequence of operation, affording safety to life and protection against damage to equipment. In general, interlocking within one unit involves some simple mechanical arrangement that can hardly get out of order. Interlocking between units is usually provided by simple electrical means.

Simple mechanical interlocks prevent the following: (1) Plugging the removable portion in when the main breaker contacts are in a closed position; (2) closing the switch when the removable portion is not plugged fully in; (3) withdrawing the removable portion when the main switch contacts are in a closed position; (4) removing the oil tank before removable portion is withdrawn.

Other interlocking features include the following: (1) The racking-in attachment automatically locks the circuit breaker carriage when it is plugged clear into the fixed portion. The breaker cannot be closed until the lock is secured, and once closed the lock cannot be removed until the breaker is reopened; (2) withdrawal of the switch automatically closes the locking-off doors over the socket orifices on the busbar and transformer chambers, thus preserving the complete coverage of the conductors whether the removable portion be plugged in or withdrawn; (3) when the switch is isolated, the doors may be padlocked, thus preventing unauthorized interference.

Group Versus Individual Motor Drive

The Process of Manufacture Largely Determines the Most Suitable Type of Drive to Be Employed— Basic Principles Given

By LOUIS F. LEUREY
Consulting Electrical Engineer, San Francisco, Cal.

FIG. 1—INTERIOR VIEW OF GRINDING FLOOR IN MODERN FLOUR MILL, SHOWING GROUP DRIVE OF GRINDER ROLLS AND COMPACT ARRANGEMENT OF UNITS

TO GET a proper perspective in studying the problems of group versus individual drive in industry it is necessary to review briefly the history of the growth of American industry and to recognize the part that early developments have played in building industrial practice as we know it today. It cannot be gainsaid that to a large extent engineers are guided by existing practice in laying out each new installation and that this practice is generally the result of an evolutionary development within a branch of a given industry.

In the earlier industrial plants, whether they were mining plants of the West, cotton mills in New England or flour mills in the Middle West, all had to depend on some form of mechanical prime mover, which of necessity had to be located at one fixed point, with mechanical transmission to the various groups of machinery to be driven. Neither the gas engine, the waterwheel, nor the steam engine was adapted for driving single machines, except where these constituted a piece of machinery of considerable size. The result was that the design and application of most types of milling machinery have been strongly influenced by this early necessity for keeping machines as close as possible to the central prime mover.

With the coming of the electrical era and the development of the electric motor a revolutionary change was brought about in the application of motive power to industry. The extreme portability of electric power and the ease and safety with which the electric motor could be installed at any point in the plant completely changed the design and arrangement of most industrial plants. Designers of these plants could now take full advantage of decentralization and could lay out their plants with regard to the most economic types of buildings and the most advantageous groupings of machines to handle products in and out of the plant. In the transition from the mechanical to the electrical era there was in the past and there still remains a considerable carry-over of inherited ideas, with the result that in many plants today both the old and the new types of installation may be seen side by side. Manufacturers, as a rule, are slow to adopt new practices until they are thoroughly established in the industry as a whole, and are naturally loath to introduce them, especially in going plants where the prospective improvements would mean the wiping out of a large investment.

The engineer who is broad enough in his training to recognize the importance of the business and economic aspects of plant operation will realize that the problems of modifying the structure of a going plant are totally different from those of laying out an entirely new plant of a corresponding output. Each problem in plant design or motor appliance must be worked out with due regard to all factors involved, and the following discussion will seek only to point out those factors

and their influence that must be given full consideration before a sound solution can be secured.

In certain types of industrial establishments there is almost an automatic segregation of types of drive that can be adopted, due to the physical characteristics of the machinery and buildings. In such cases the problem becomes comparatively simple and practice has become so standardized that no engineer could be accused of lack of foresight if he adopted general practice and duplicated existing elements. Perhaps it will be best to illustrate this point by two typical products, flour and cement, both of which have similar characteristics in that they require large amounts of power for grinding and are of the high load factor, continuous output type and in every way comparable, except as to the physical placement of the component machinery and buildings to form a well-balanced production unit.

Flour mill machinery is especially compact and lends itself admirably to an arrangement in high buildings of small floor area in which the product travels continuously in vertical lines and is finally sacked off and delivered to the warehouse by means of a simple conveying system. In this type of plant it is now quite common practice to install a single, large, slow-speed motor directly on the roll shaft, where approximately two-thirds of the power is consumed, and counterdrive up from this shaft to each floor above for the driving of sifters, elevators, dust collectors and other machinery that consumes the remaining one-third of the motor's output.

The load factor will run 80 per cent or better on such a motor, which, due to its size, will have excellent efficiency and power factor in spite of its slow speed. The fact that all machines on the upper floors as well as the roller floor arrange very well in horizontal rows of uniform spacing makes this a simple problem in mechanical transmission and is one of undoubted efficiency, as the belting and shafting do not in any way interfere with the physical handling of the product, all of which is done in closed conveyors and spouting.

There is a tendency now in flour mill drive to break up the central motor scheme and drive several of the floors from independent motors, but leaving aside the merits of this, it will not alter the fact that flour mill drive will remain essentially of the group type.

The cement plant, although it has the same continuous flow of product as the flour mill and has the same heavy kilowatt-hour consumption, is radically different due to the bulk and the necessary style of arrangement of its component machines. The crushers, grinding mills and kilns of a cement plant are heavy, bulky pieces of apparatus that do not lend themselves to arrangement in vertical tiers but must be spread over large areas in a horizontal plane. The size of each individual unit as a rule requires driving motors of 100 hp. and over and everything combines to make it an ideal type of installation for individual drive. In this type of plant the flexibility of electrical distribution permits the most advantageous placing of equipment from a production standpoint. On account of the dust problem as well as physical differences in the product, cement is usually stored in buildings apart from the manufacturing plant and sacked off in these plants. Thus it is seen that cement manufacture is a process where individual drive cannot be equaled by any form of grouping.

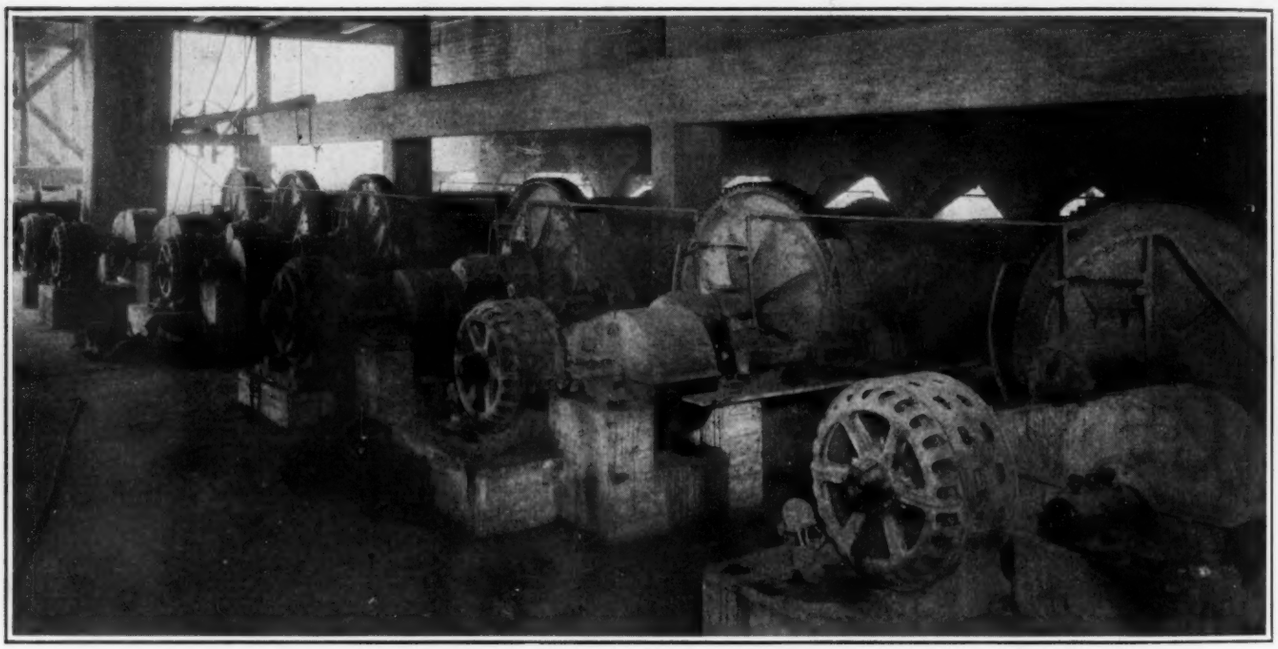


FIG. 2—TUBE MILL DRIVE IN A MODERN CEMENT PLANT, SHOWING INDIVIDUAL MOTOR DRIVE WITH CHAIN BELT AND GEAR SPEED REDUCTION

Modern cement mills are entirely individual drive, with a tendency to eliminate intermediate speed reductions by belt or chain and to drive grinding mills by synchronous motors, either of the self-starting type or of the standard type with magnetic clutches.

We see, therefore, that in the manufacture of flour and cement and similar processes of manufacture there is almost an automatic segregation of what is the advisable form of drive. Lying between these two extremes there is a vast field of industrial establishments where business judgment and engineering technique must decide each individual case upon its merits before any particular drive can be decided upon, and in many cases a sound decision will result in partly grouping certain portions of the plant and in other portions going to individually driven machines.

Closely following an analysis of the question of drive from the standpoint of type and character of building and machinery comes the problem of producing a well-adapted drive for the machine itself. This problem is, of course, very closely related to the problem of machinery grouping and is the one that most frequently governs the choice between individual and group drive in the majority of establishments. Although the invention of the induction motor has been a great boon to the manufacturing industry because of the flexibility with which it can be installed throughout a plant, this has been offset to some extent by serious limitations in the way of available speed ranges, except in the field of extremely low speeds, where the choice is large. The cost of slow-speed motors, however, is correspondingly high, and efficiencies and power factor are as a rule materially lower. The designer is thus confronted with the problem of the individual machine and must consider a number of important factors before arriving at a decision. Nearly all industrial machinery has an inherent speed requirement much lower than rated speeds of induction motors and calls for some form of speed reduction.

In considering the problem of speed reduction countershafting drive as a rule offers a ready solution, but at the same time introduces the disadvantages of clumsy overhead structures that are high in first cost, low in efficiency and very often seriously interfere with the handling of the product. As a rule counterdrive does not materially increase the space requirements in a factory, as it can generally be attached to the ceiling and does not necessarily occupy valuable floor space. In case of heavy duty machinery, however, this is not held true and counterdriving must be additionally charged with the cost of the valuable floor space which it occupies.

In recent development for drives of 100 hp. and over there has been a marked tendency to use the synchronous motor, which, by the use of magnetic clutches or revolving rotor and revolving stator with mechanical clutch, has been adapted to overcome the poor starting characteristics that in the past were the drawback to synchronous motor installations. This use of the synchronous motor with its excellent power factor characteristics and its adaptability to low speed ranges is offering a wide field for individual drive applications, but it must be said that to date the use of synchronous motors in this manner is largely in competition with induction motors.

In the field of light drives the comparatively recent development of the self-contained unit gear reducer inclosed in metal housing has had a marked influence on accelerating the adoption of individual drive, especially in those cases where counterdriving covers a wide range of speed and where shafting cannot conveniently be placed on the ceiling or where its position on the ceiling would materially interfere with the handling of the product.

The self-contained gear reducer has lent itself admirably to compact floor space arrangements and has further been entirely in keeping with the modern movement for personal safety, which calls for the inclosure in some form of all moving gear trains. To date the application of speed changers has been largely in the field of light drive and its extension to the field of heavy drive will be developed as the economies of the situation prove necessary.

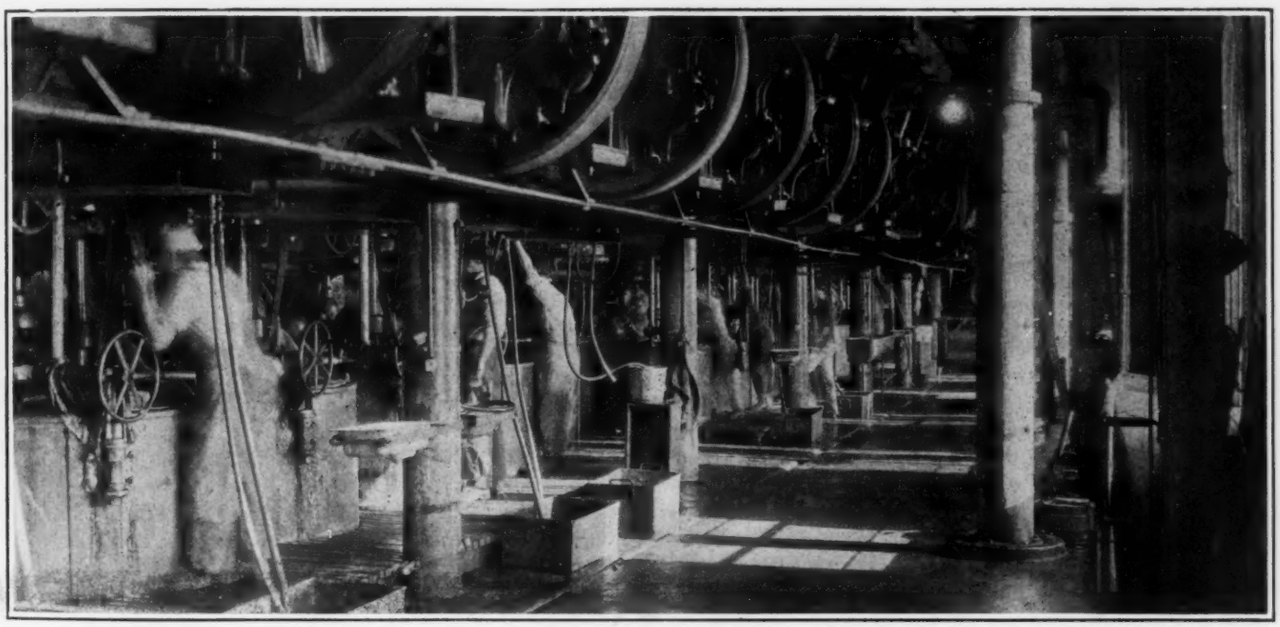


FIG. 3—GROUP DRIVE OF SUGAR CENTRIFUGALS IN AN UP-TO-DATE SUGAR REFINERY. THE MAIN SHAFT IS DRIVEN BY A 150-HP. MOTOR LOCATED AT THE END OF EACH GROUP OF EIGHT MACHINES

In studying the relative merits of group versus individual drive one of the most important features, though a collateral one to the general question of plant arrangement, is the question of power consumption and relative first cost. Although as a rule these factors are given first place in the consideration of most problems, the writer believes that in the above comparison they should be subordinated to the problem of the best plant arrangement and should be then treated on their own merits as one of the tributary collateral reasons for arriving at a decision.

Into this question of power costs and investment costs enters a wide variety of problems and opinions upon the whole queston of over-all production efficiency. In many types of manufacturing establishments variable speed motors with automatic stop and start and dynamic braking are installed in spite of the fact that

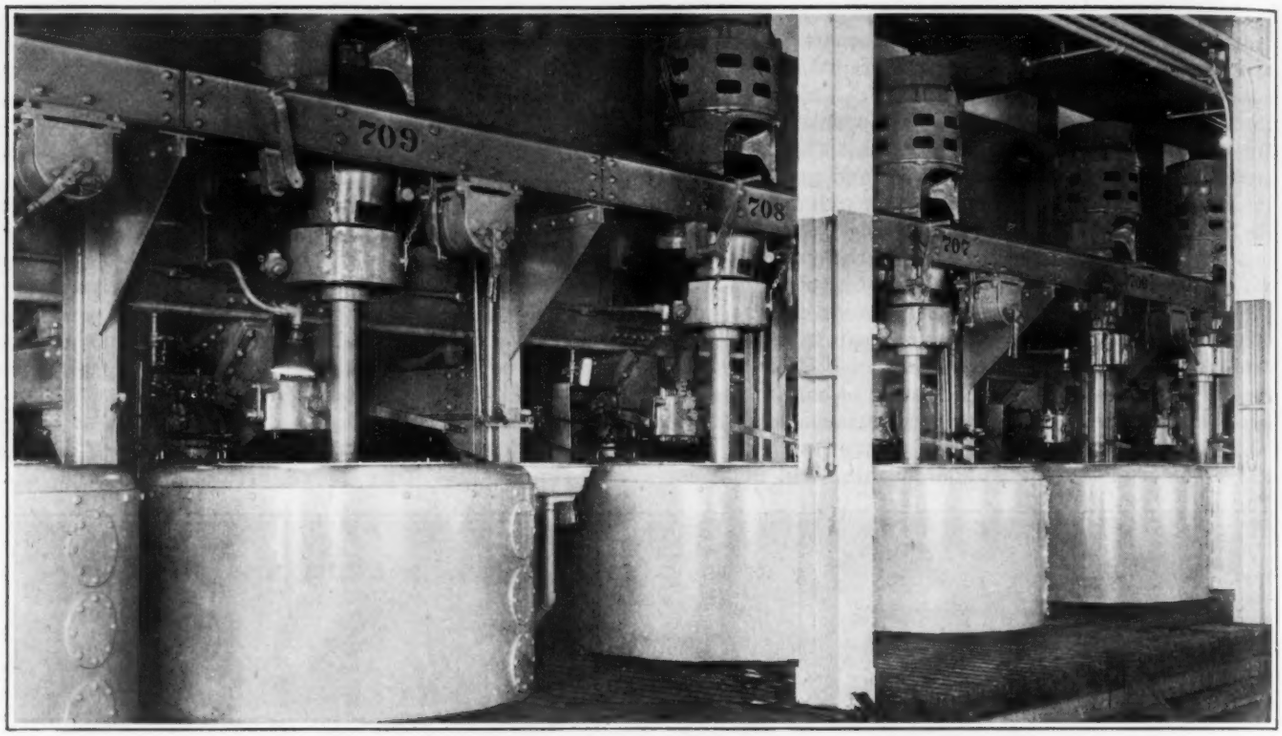


FIG. 4—APPLICATION OF INDIVIDUAL DRIVE TO SUGAR CENTRIFUGALS IN THE SAME REFINERY AS THE MACHINES SHOWN IN FIG. 3

this is one of the most expensive types of installation from the standpoint of power consumption and is also probably the most expensive when first cost is considered. However, when we balance against this high first cost and high power consumption the material speeding up of the individual machine and its corresponding increase in output, it will often prove to be unquestionably wise to make the more expensive installation. This type of installation generally has its most favorable field in the iron trades, where rapid inspections of work must be made by high-priced and skilled workmen and where the product consists of a number of operations that must be performed in succession at varying speeds and with numerous stops and starts.

On the other hand, there are other processes of manufacture where the power saving due to group driving is so material and the lowering in first cost is so great as to make group drive unmistakably the thing to install. In many of these cases, as a further collateral advantage, it enables the metering by one instrument of the output of a department under conditions where power is a large factor in production cost and where an accurate check on production costs is a physical necessity to the sales program. An example of this type of plant is in the field of cereal milling, where often under one roof a number of different kinds of cereals are milled, each by its own group of machines and each sold on its own merits and not as a byproduct of any other.

In many manufacturing processes, such as the fabrication of dry batteries, there necessarily occurs an innumerable number of small operations intermittent in character where the power consumption of each individual operation is of nominal proportions but in which every now and then sharp peaks of demand arise. To motorize this type of equipment individually would undoubtedly make a more sightly looking plant but would not result in increasing the production per foot of floor space, but on the other hand it would materially increase the first cost due to the increased number of small motors necessary and would materially increase power consumption due to the poor load factor of the individual motors involved. In this kind of plant a counterdrive can generally be placed on the ceiling, where it affords a cheap and flexible method of securing the large range of speed reductions necessary. It does not in any way interfere with the handling of product and allows the use of a minimum number of motors having a maximum of efficiency and load factor.

To sum up a consideration of the principles set forth in the foregoing, it may be well to consider a definite application where these principles can be employed in a concrete manner. Two types of centrifugal drive for drying sugar, one being a typical group installation and the other being a good example of the same service but with motors individually applied to each centrifugal basket, are shown in Figs. 3 and 4, respectively. For comparative purposes it might be said that in the group drive installation eight centrifugal baskets could successfully be driven by a 150-hp. belted motor with counterbelting between a common drive shaft and the individual centrifugal baskets and with the further use of a mechanical clutch between this shaft and the driven basket. In Fig. 4 it is shown how eight baskets of a similar capacity could successfully be driven by eight 40-hp. motors. In summing up the advantages and disadvantages of these contrasting groups it must be kept in mind that it would make a great deal of difference whether the direct drive covered an addition to an existing installation or whether it would contemplate the conversion of baskets driven from a common shaft.

Compared on their merits, it will be noted that the two installations occupy practically identical floor space. The belt group, being fastened from ceiling hangers

over an aisle, does not in any way increase the amount of factory space involved, so from the standpoint of space saving the two installations would show little difference except for the space occupied by the 150-hp. motor and belt at the end of the countershafting. The cost of motors in the direct-driven group is very much higher both as to price per horsepower and as to total horsepower installed. The cost of the electrical control and wiring is correspondingly high. As a direct offset, however, to this disadvantage is the reduced cost in maintenance, as the cross-belt driving of a centrifugal basket is very high in belt wear and there is a correspondingly high upkeep of clutch pulleys and shafting. Furthermore, the oiling of such a system is a steady operative item both as to labor and lubricant.

The relative first cost of the two installations is largely a result of the location and circumstances under which they are built. The successful installation of a direct drive usually involves a design that must go back of the centrifugals themselves and involves the shape and size of bins and mixing devices that deliver the product to the centrifugal baskets. Finally the commercial answer in total tons of refined output per unit of investment and unit of operating costs must be sought as the only guide to final selection. The flexibility of the direct drive enables a much more rapid duty cycle of the individual centrifugal basket and is generally the deciding factor in determining the final commercial efficiency.

In conclusion it may be well to point out that not only must the industrial engineer be capable of making a thorough analysis of each individual case that is presented to him but he must be open-minded and must keep himself especially well informed on all of the developments in the trend of modern industrial practice. It is insufficient to say that a certain installation is in line with present-day practice, because the success of present-day practice has depended on the far-sighted evolutionists of an earlier period who were not content with the practice of their day.

Chicago Ducts Ready for 132-Kv. Cable

Will Allow Tying Stations Inside and Outside City by High-Voltage Circuits Without Usual Number of Costly Intermediate Transformations—Will Also Increase Cable Capacity Sixfold, Reduce Line Drop and Loss and Incidentally Improve Power Factor

SIX MILES of duct line and the corresponding complement of manholes have been completed by the Commonwealth Edison Company to accommodate the 132,000-volt underground cable now on order, according to W. G. Kelley. It is expected that the cable will be received this coming summer and will be installed and ready for service in the fall. As previously explained in these pages, this cable will extend from the Northwest station in a northerly direction to a point where it will be joined directly with the 132,000-volt overhead lines of the Public Service Company of Northern Illinois from its Waukegan station.

Thus direct connection can be made between the generating station outside Chicago and the station inside the city without the usual number of costly transformations and the increased voltage drop and energy loss resulting from transmission within the city at a lower voltage. Furthermore, it will increase the carrying capacity of a single underground circuit to 91,000 kva., or about six times the present maximum with the three-conductor, 33,000-volt cables used. Owing to the larger charging current of this new cable, it will also be possible to improve the power factor of the system load, although this advantage is incidental and not one that dictated the use of the cable.

Comparing charging currents, Herman Halperin says that the existing three-conductor, 33,000-volt, 15,000-kva. cable has a charging load of about 150 kva. per mile, whereas the new 132,000-volt underground cable will draw about 2,400 kva. per mile. Thus for the

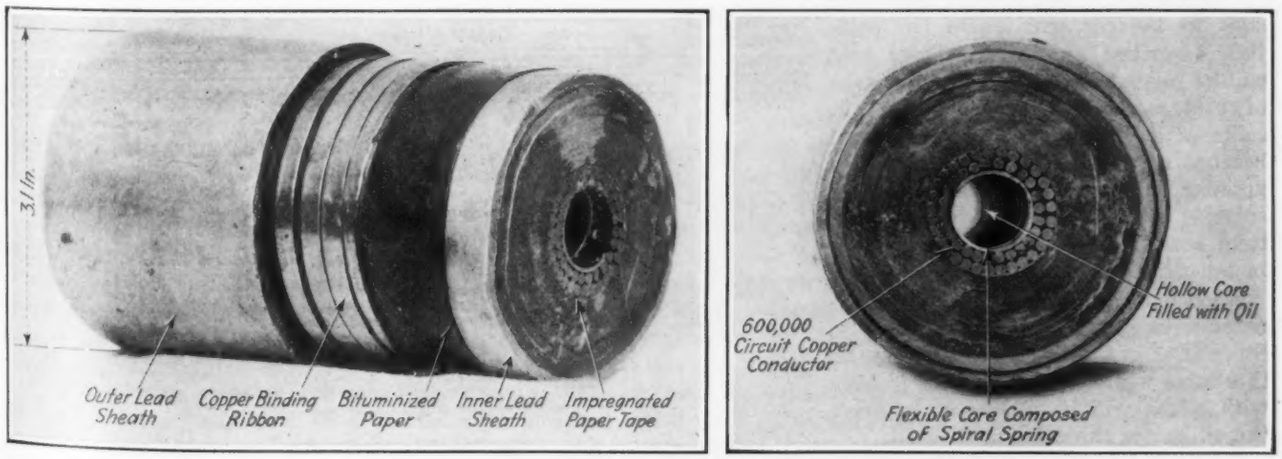


FIG. 1—HOLLOW OIL-FILLED 132,000-VOLT CABLE

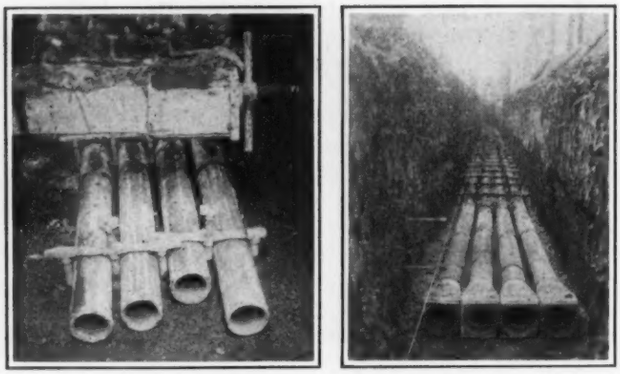


FIG. 2—132-KV. CABLE DUCTS IN PROCESS OF CONSTRUCTION
Careful grading of trench, accurate spacing of ducts and alignment of joints features of duct line.

present planned installation of 132,000-volt cable the charging load will be 14,000 kva. with a leading power factor of about 1 per cent. If the 70,000-kva., 85 per cent power factor, 60-cycle generators at Northwest station were carrying their full kilovolt-amperage load at 70 per cent lagging power factor and this six-mile section of 132,000-volt underground cable be connected thereto, the charging load of the cable will enable the generators to carry 11,000 kw. additional load at unity power factor. However, the cost of the condenser capacity provided in this way is much greater than when obtained by synchronous or static condensers.

As shown by the accompanying cross-section of the new cable, there is a $\frac{3}{4}$-in. flexible tube at the center made by wrapping flat wire in spiral formation around a mandrel. On this hollow core are wound the strands of a 600,000-cir.mil copper conductor. The insulation is $\frac{33}{32}$ in. thick and consists of more than a hundred layers of impregnated paper tape. Two lead sheaths are provided which are insulated from each other by a few layers of bituminized paper wrapped with hard-drawn copper ribbon. An outstanding feature of the cable is that its insulation will be impregnated with a very thin oil (having about the consistency of kerosene) which will always be kept under pressure so that no voids will be formed in the insulation. This will be made possible by the construction of the cable just described and by facilities that will be related later. Chiefly by reason of this method of impregnating the cable with oil and to a certain extent because of other features it has been possible to make the thickness of insulation of this 132,000-volt cable less than used on 66,000-volt cable recently installed in this country.

Each length of cable will be impregnated with oil and tested at the factory. Since it is impossible to make joints in this cable while the hollow core is filled with oil, it will be necessary to drain the oil before the cable is shipped.

To limit the loss of oil that might result from cable failure, the cable installation will be divided into one-mile sections, which will be separated from one another by barrier joints wherein the conductors will be connected but the hollow cores of adjacent sections will be blocked from each other. Within any of these one-mile sections the cable joints will be made so that the hollow core will be continuous. The details of the barrier and intermediate joints have not yet been completely determined.

OIL UNDER STATIC PRESSURE FURNISHED BY ELEVATED TANKS

After installation, each cable section will be heated by current in the conductors, air pumped out of the cable and the cable filled with oil. To maintain a hydrostatic pressure on the oil, a pipe line will be run from each barrier joint to a 50-gal. oil reservoir mounted 40 ft. above the ground. With this provision, when the cable becomes warm, oil will flow from the reservoir into the hollow core of each cable through the spiral spring which composes it and the copper strands into the paper insulation. When the cable cools, the oil flow will be in the opposite direction. Furthermore, if oil is lost from one cable, the drain will not affect other cables in the same section or any cables in adjacent sections.

It may be of interest that in this single-conductor, high-voltage cable, current of about one-half the conductor current will be induced in the two lead sheaths, whereas in the sheath of a three-conductor cable there is practically no induced current.

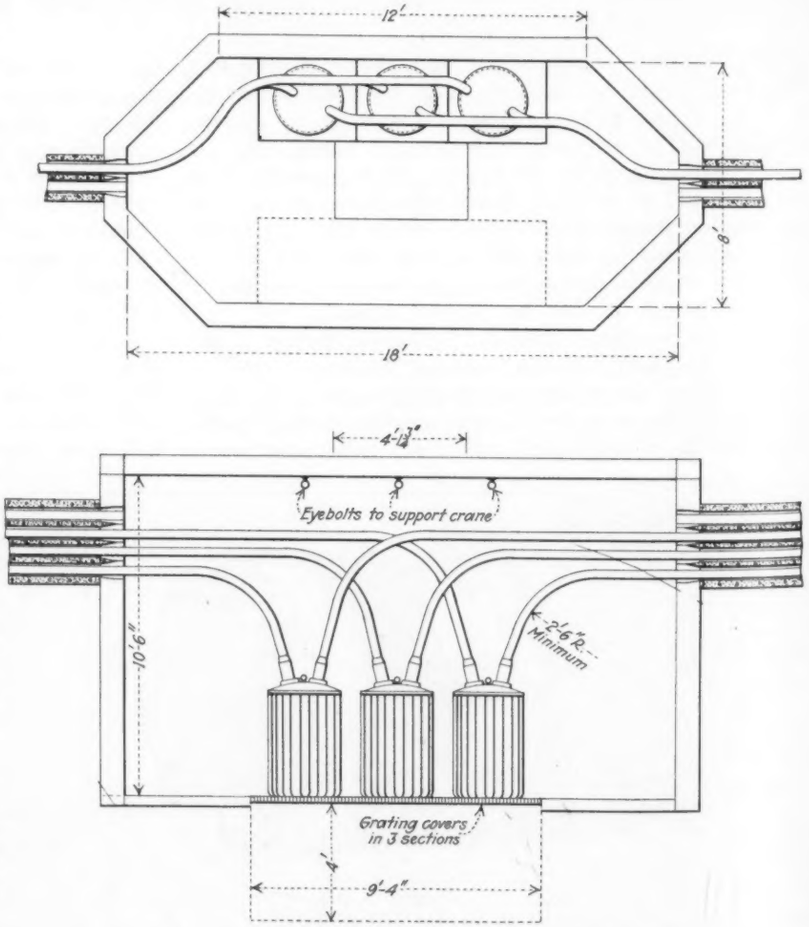


FIG. 3—TENTATIVE IDEA REGARDING BARRIER JOINTS AND ARRANGEMENT IN MANHOLES

Special conduit and manhole construction is required for this new cable and was built under the supervision of the distribution division. (The street department will install the cable.) The conduit consists of eight 4-in. stone ducts, obtained in 3-ft. lengths and laid to assure perfect alignment and permit easy installation of the cable.

For use with this cable a straight-through manhole will be about 16 ft. long, which is about twice as long as the manholes this company has used in the past. Even larger manholes will be required to house the barrier joints—about 18 ft. long by 8 ft. wide by 10 ft. deep. In these manholes will be a 4-ft. basement to facilitate the handling of the barrier-joint tanks. The manholes are 500 to 600 ft. apart.

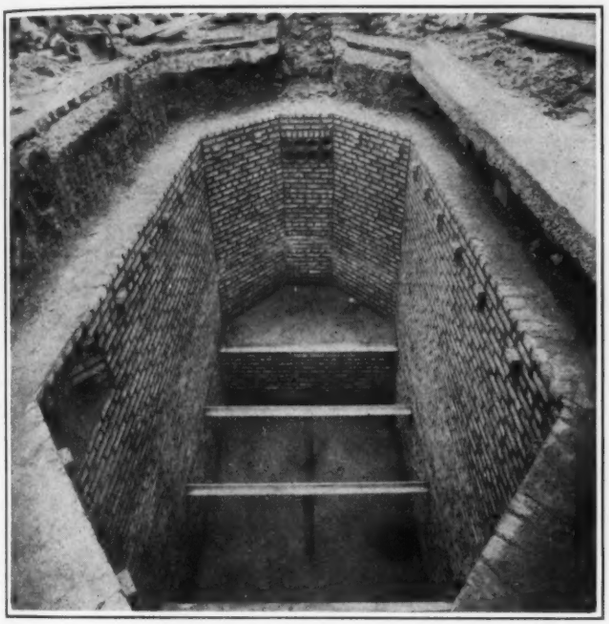


FIG. 4—BARRIER-JOINT MANHOLE FOR 132-KV. CABLE
Sub-basement is to accommodate barrier joints. Intermediate manholes are similar but smaller and do not have sub-basement.

CLOSE TRENCH GRADING AND ALIGNMENT OF DUCTS

In building the underground duct system it was necessary to devote special attention to levels and slopes and not allow any radius of curvature under 600 ft. To facilitate this work each trench was opened at one time over the entire length between manholes and graded to allow for the installation of the conduit and avoid obstructions. Some measure of perfection of the installation is indicated by the fact that a 3-ft. 3¾-in. mandrel was pulled through the entire duct line with ease, although there was only ⅛-in. clearance between it and the duct on each side in tangent runs and less on curves.

Terminal structures will be installed at each end of the underground line. At the city limits connection will be made to the overhead wires through disconnecting switches. At the Northwest station there will be three single-phase, 15,000-kva. transformers, each having a full-capacity winding rated at 12, 33 and 132 kv. respectively, the 132-kv. terminals for bus attachments and the 33-kv. terminals for 33-kv. line attachments. Special testing apparatus for this high-voltage cable will also be located there.

Conti Dwells on Advantages of Interconnection

Social and Economic Pressure Forces Interconnection—National Laws Should Permit Developments to Be Made Freely

A PROPHECY that national frontiers and even the sea will fail to check the development of international "superpower" electrical development was made in an address which Ettore Conti, president of the Second General Conference on Communications and Transit of the League of Nations, delivered at a meeting of the International Chamber of Commerce at Brussels.

This development was presented in the light of an economic necessity by Mr. Conti, who estimated that in 40 or 50 years the total available hydro-electric power will have been developed. "It is of vital interest to world economy," he said, "that two great fundamental problems, closely connected with each other, be solved, —namely, to put at the disposal of the public the greatest amount of power at the lowest possible cost with a continuous and reliable supply from available sources, and to obtain the most efficient utilization of the power reserves available. To achieve these aims it is necessary to construct reservoirs near to the power stations installed on high mountains, to exploit the sources to their fullest capacity, to make economic and rational use of fuel in the big thermal power stations and to insure interconnection between the various plants."

NATURAL RESOURCES SAVED BY INTERCONNECTIONS

Mr. Conti maintained that in many large installations —the Gennevilliers station in France, the Golpa station in Germany and the Hellgate, Colfax and Calumet stations in America—natural riches are being wasted. "These riches," he continued, "will not last forever, and it is therefore our duty to economize and conserve them as much as possible for future generations. To this end there is a great necessity for large and extensive connections between the different power stations and the distributing networks. This is what is meant by 'superpower.'

"At the present time there are many systems which operate in parallel, and further extensions are being studied. Today not only are we able to transfer energy from one place to another, but even across frontiers from one country to another. Switzerland, rich in hydro-electric resources, exports power to Italy, France and Germany; France is also connected with Belgium. Even the sea is no longer an obstacle to this new form of connection between nations, for at the present time the transportation of power from Scandinavia through the Baltic Straits to Denmark is being realized by remarkable transmission installations.

"Unfortunately laws do not exist in every country which facilitate the acquisition of the necessary lands for installations. As regards international legislation, we must recognize that political barriers, sometimes artificial, ought not to hinder the exploitation of water sources situated on the frontiers; that it is necessary to help the country whose hydraulic resources are more than sufficient for its own needs so that some can be employed by other countries, beyond the frontiers, less favorably situated."

Toronto Station Designed for Base Load

Boilers Use Pulverized Fuel—The House Turbines Operate with Automatic Heat Balance System—Unit Type Control for Main Generators and Auxiliaries

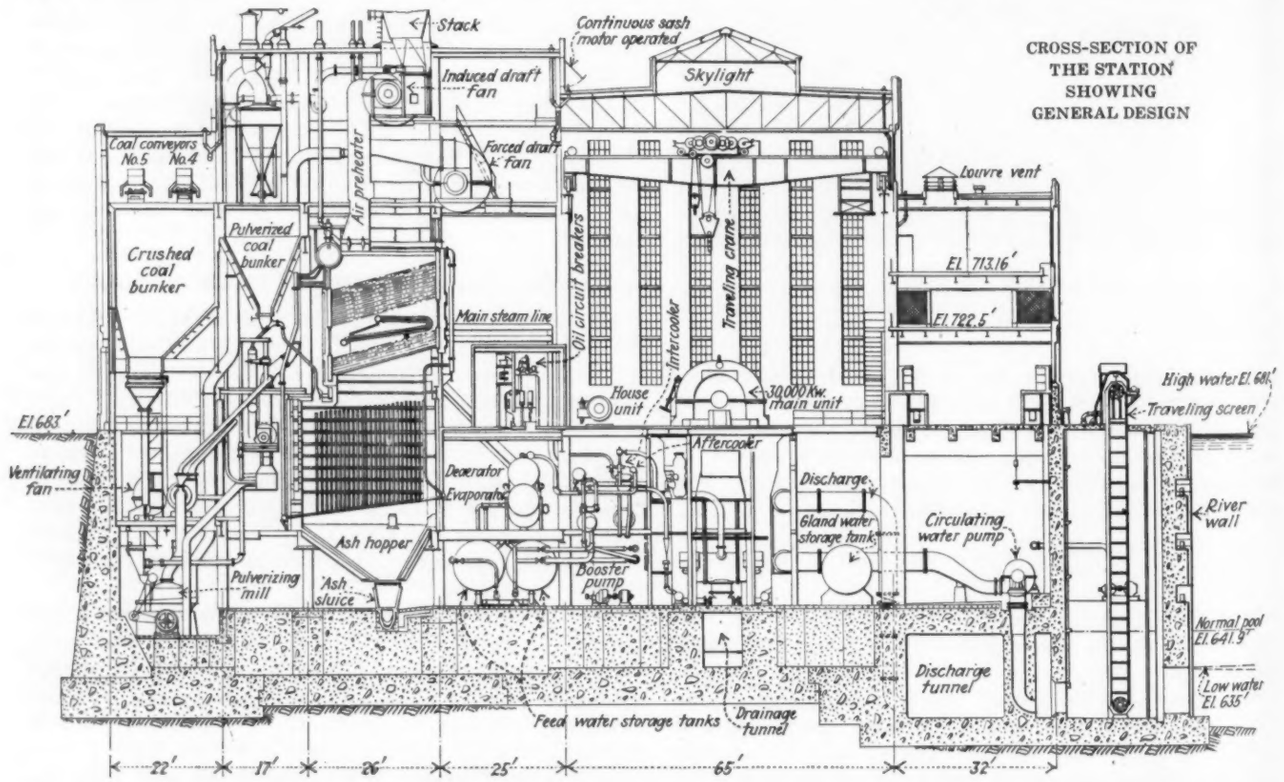
By J. H. WELLS
Electrical Engineer Stevens & Wood, Inc., New York

THE necessity of caring for the continually increasing demand in the area in and about Youngstown, Ohio, and Sharon and Ellwood City, Pa., has resulted in the construction of the initial section of a major power plant development on the Ohio River just north of Toronto, Ohio.

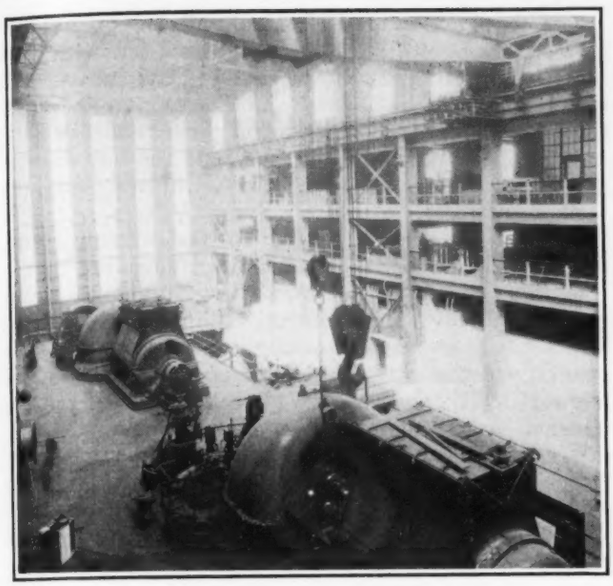
Although the area to be supplied with power from this plant lies almost wholly more than 40 miles north of the plant, conditions of river water for condensing purposes and the facility of coal supply constituted factors resulting in the location of the plant out of the "territory" served by the operating company. The development, which was designed and constructed by Stevens & Wood, Inc., includes the erection of the first section of the Toronto power station, containing two 33,000-kw., 80 per cent power factor, 11,000-volt, 60-cycle, General Electric steam turbo-generators, together with the necessary auxiliary equipment, boiler plant and step-up station; 40 miles of double-circuit 132-kv. transmission; construction of a switching center connecting in the Toronto development to the existing transmission system of the Pennsylvania-Ohio Power & Light Company, with provision for the ultimate Toronto station capacity. The initial development is 25 per cent of the ultimate capacity of the plant.

The coal supply is normally secured from a strip mine located four or five miles back in the hills, with a single-track railroad connecting directly to the plant, where provision is made for receiving coal directly from the standard hopper bottom cars, crushing it and carrying it either to storage or direct to the raw coal bunkers in the boiler plant. Coal storage is provided in the yard for approximately 100,000 tons at the present time and for several times this amount in the future. The boiler plant is designed for the exclusive use of pulverized fuel and is equipped with four B. & W. boilers, each having a heating surface, including water screens, of 22,500 sq.ft. The water screens are provided on both sides, at the rear and bottom of the furnace. Steam will be delivered to the turbines at 350 lb. gage pressure and 214 deg. F. superheat, giving a total steam temperature under normal operating conditions of full load of 650 deg. F. Provision is made for a small raw coal storage in bunkers in the boiler plant directly above the pulverizer and with a second set of bunkers providing ten hours' supply of pulverized fuel. Pulverizers are installed on a plant basis—that is, the pulverized fuel may be moved between any pulverizer and any boiler. Three of the boilers will carry the entire load when such operation is necessary.

The combustion system includes the use of forced draft fans, induced draft fans and air preheaters on



CROSS-SECTION OF THE STATION SHOWING GENERAL DESIGN



INTERIOR OF TURBINE ROOM

the basis of obtaining the maximum economy from the utilization of the flue gases and the boiler equipment. The entire combustion system will be automatically controlled through the use of the Smoot system of regulation, with provision for emergency manual control.

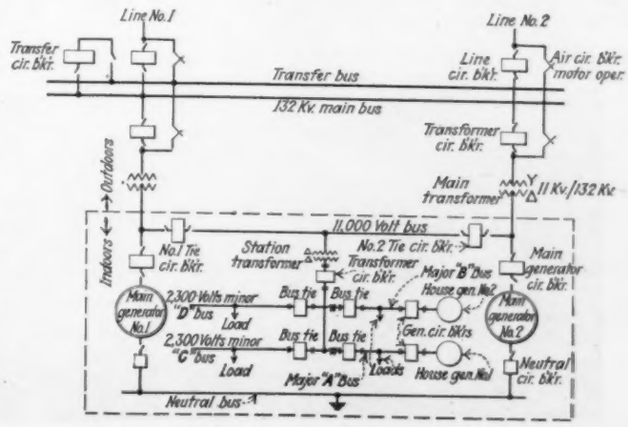
The heat balance of the station is obtained through the use of a house turbine with each main turbine. The house turbine normally carries the larger portion of the major auxiliaries such as circulating pumps, boiler feed pumps, fuel feeders, etc., and is fed with steam at boiler pressure and bled at a constant pressure of 196 lb. and 52 lb. absolute, exhausting at 18 lb. absolute to the de-aërators. These two bleed points of the house turbine are in addition to three bleed points on the main turbine, one of which supplies steam to the evaporators, giving essentially automatic heat balances for the various conditions of load. The house turbines are paralleled on the electrical side with the station so as to permit them to carry the exact portion of the load that the steam requirements indicate. In the event of the breaking of this electrical tie the house turbines are automatically changed over to non-bleeding operation, unloading the 195-lb. belt to the atmosphere at 40 lb. absolute, and then have a capacity ample to provide the operation of all major auxiliaries necessary for the continued service of its main turbo unit, including the necessary boiler equipment for steam generation. This method of heat balance provides a consistent temperature at all loads, continuity of service for auxiliary loads and Rankine efficiency practically equal to that of the main unit, complete independence of auxiliary service from outside and main unit disturbances and no hand adjustment for the heat balance.

The main generators are connected, through a low-voltage switch for synchronizing purposes only, direct to the transformer, stepping up from the 11,000 volts generated to 132,000 volts for transmission purposes to Youngstown. There is no paralleling of units except at the high voltage. The station auxiliaries are fed from a connection taken outside of the low-voltage synchronizing switch on the main generator circuit. The entire electrical design is based on two main generators as one unit with a total capacity of 75,000 kva. The transformer for the station auxiliaries may be connected to either but not to both of the two generators taken as such a unit. The transformer bank for supply of the station auxiliaries is of 5,000-kva. rating and may be operated open delta if one of the units fails. The remaining capacity is adequate for all minor station load. The transformers are paralleled with the house alternators through 20 per cent reactors so as to provide certainty of service to the major auxiliaries by a double source of supply and with the reactor arrangement and relay arrangement such as to protect the auxiliaries against possible failure from loss of power at either source.

The house generators, which have a steam end rated at 1,500 kva. when exhausting at 40 lb. absolute, are connected to a 2,300-volt, three-phase generator rated at 3,150 kva. Each house set feeds one of the major buses, each of which supplies one main turbine and is designed to be operated in parallel with the main units with maximum field excitation. When operating independently of the station they will automatically become standard load governed turbine units regulated for 2,300 volts. The regulation is controlled by the use of Tirrell regulators adapted for the particular application. The set-up is so designed that the voltage on the major auxiliary bus will at no time fall below 70 per cent due to any fault on the system.

All motors on auxiliary equipment are designed to be thrown directly across the line without starting equipment and are required to carry their load at 10 per cent above or below their normal rating of voltage and for momentary dips of 30 per cent of voltage. From one or two instances in the preliminary operation the system has indicated its ability to function satisfactorily. Provision is made so that if the voltage drops 20 per cent or more the house turbine automatically becomes non-bleeding and governs as a load machine to hold the auxiliary voltage.

All auxiliary equipment of 30 hp. or larger is operated at 2,300 volts and all equipment of less than 30 hp. is operated at 440 volts. The 2,300-volt equipment is controlled from a truck type switchboard through control switches placed at the individual motors. All motors are protected simply with an overload protection set slightly above the starting current required. The starting current in all cases has been limited rather materially below the ordinary commercial figure. All 440-volt equipment is controlled from contactors located at the transformer banks used for stepping down from 2,300 to 440 volts. The design has provided the location of the 440-volt transformer banks as nearly as possible adjacent to their center of load to minimize the low-voltage circuiting. These contactors are all remote control from a control switch located at the individual motors. All motor connections on both



SINGLE-LINE DIAGRAM OF THE ELECTRICAL CONNECTIONS

the 2,300-volt and the 440-volt are steel clad. All of the motors for general service purposes are squirrel-cage induction motors. The circulating pumps are two-speed induction motors and the draft fans and coal feeders are wound-rotor motors having a four to one speed range.

The main generators are supplied with coil type coolers and a totally inclosed ventilating system, so that on machines sold on the manufacturers' rating of 30,000 kw. at 80 per cent power factor we can maintain 33,000 kw. under all conditions and have found it practicable to carry loads in excess of 35,000 kw. with proper water temperatures. These machines are also equipped with a CO_2 device for fire fighting. The system used is the so-called "Lux" system wherein CO_2 stored in tanks of 1,200-lb. pressure is automatically released by split-winding differential relays or at the option of the operator by a button on the turbine room gage panel. The CO_2 at high pressure is conducted through pipe lines to the generator housing and there released and allowed to expand. The cylinders are arranged for an instantaneous release of seven units with a delayed release of seven units, one at a time, in order to obtain a minimum percentage of 30 per cent CO_2.

The operation of the generators is controlled through voltage regulators with ranges from 10,500 to 12,500 volts to maintain pressure at far end of transmission line. The house turbo-generators are equipped with regulators which, while the units are tied in with the system, give the generators a maximum field so as to produce maximum leading kilovolt amperage within the capacity of the machine. When the house turbines trip clear of the system, the regulators automatically govern for a constant bus pressure of 2,300 volts. The operation of this system has proved both practical and satisfactory.

The main station controls are centered in the control room on the upper floor of the mezzanine gallery. The control equipment is of a unit type, each unit comprising two main generators and a line panel for one 132-kv. circuit. The auxiliary turbines are controlled from a similar unit that provides for two house turbines and one house transformer panel. This unit comprises a single group and corresponds to the two main turbines and single line panel first referred to.

On the house turbine and transformer panels there are also mounted a set of lamps so connected that in the event of failure of any of the major auxiliaries the lamp lights over the particular nameplates, indicating to the operator what serious trouble has developed and giving him an opportunity to handle his operations with a knowledge of what equipment is out of service.

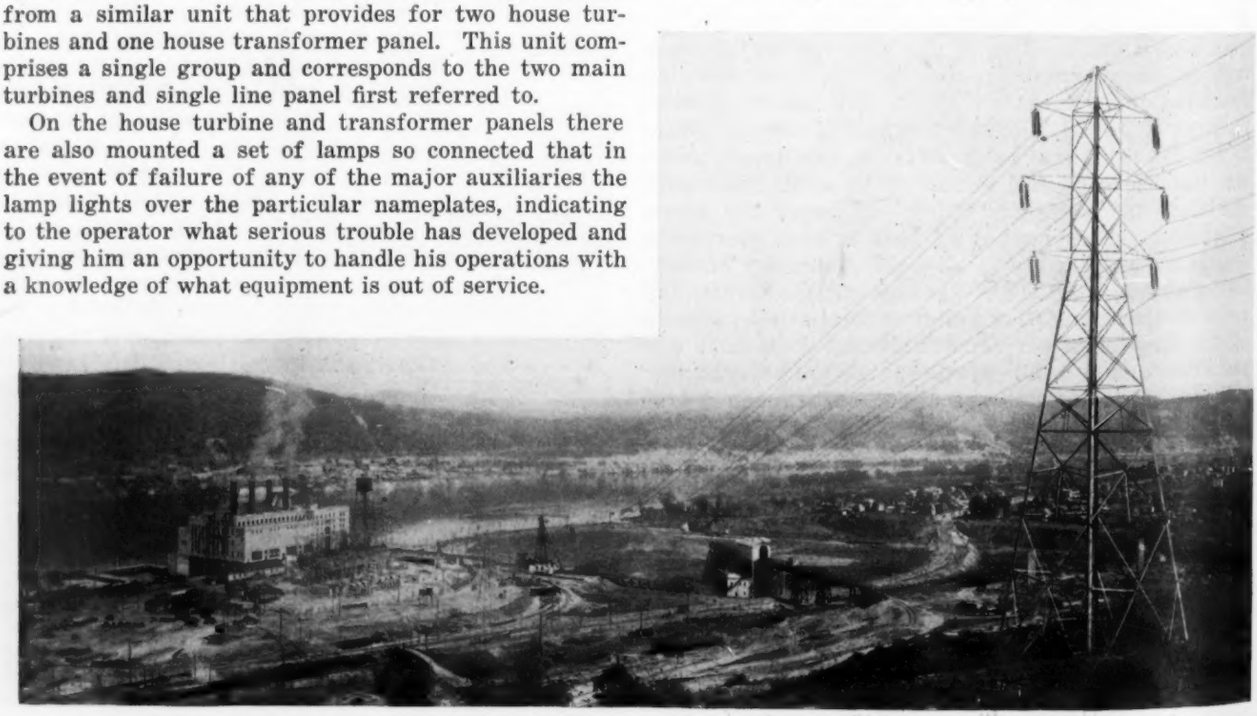
The construction of the control units, as provided, is a steel frame with steel sides and back but with slate face for mounting the equipment and instruments. The top of the unit is dished and lighting units placed therein so that the entire control room receives totally indirect illumination. The result with the formation of the board practically eliminates all glare from the instrument faces.

These unit panels contain all the wiring, relays, graphic meters, voltage regulators, indicating instruments and control switches and signal lights necessary for the equipment they control. The number of instruments has been very materially reduced from the more general practice and for each generator consists of one kilowatt meter, one reactive kilovolt-ampere meter, one alternating-current ammeter, one direct-current ammeter, one temperature indicator for the generator stator and one temperature indicator for the generator rotor, the latter being a rather new develpoment in American practice. However, it has been used abroad for a number of years and our discussion with European engineers indicates that its use has been satisfactory. The frequency, voltage and synchronizing indications are common for the station and are handled by throw-over switches.

There are further provided unit control panels on the main floor of the station to signal between the turbine room floor and the control room emergency control of the fire equipment on the generators, etc.

There is provided at each gage board a traffic signal device which carries red, green and white lights indicating which machines are in service and which are to stop and which are to start. The corresponding equipment for the house turbines is located adjoining that for the main turbines.

The primary object in development of the Toronto plant was a consideration of maximum reliability and economy at a proportionately low unit cost. The operating results to date have indicated the fulfillment of the design factors on which the development is based. An extension of the station providing for an immediate increase of 50 per cent is in progress.



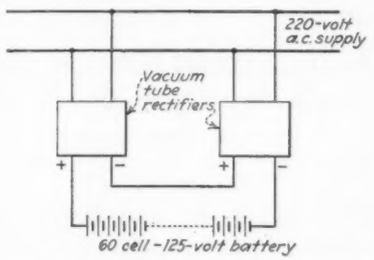
TORONTO STATION, WITH ITS SWITCHYARD, COAL-HANDLING EQUIPMENT AND OUTGOING TRANSMISSION LINE

Central Station and Industrial Practice

Station Batteries Charged with Vacuum Tube Rectifiers

BY C. F. BENHAM
Assistant to General Superintendent, Great Western Power Company, San Francisco, Cal.

THE difficulties of storage battery and charging equipment maintenance when motor generator-charging arrangements are used impelled the Great Western Power Company to consideration of other devices for charging the 60-cell control batteries in a number of unattended automatic stations on its system. The characteristics of garage-type vacuum tube rectifiers appeared to be very satisfactory, but such sets are manufactured for a maximum of only 75 volts on the direct-current output. However, it was thought that two of these rectifiers could be operated in series by using the 220-volt type, which has a double transformer winding, rather than the 110-volt type with its auto-transformer, and such proved to be the case.



TWO VACUUM TUBE RECTIFIERS IN SERIES CHARGE 125-VOLT STATION BATTERY

Care must be used in connecting the rectifiers to see that corresponding alternating-current leads are connected to the same wire of the supply circuit, otherwise the pulsating direct-current on the output side will be 180 deg. out of phase and the voltage will be zero.

It is necessary to maintain a load of from 1 to 2 amp. on the standard 6-amp. vacuum tube charger in order to secure a stable voltage on the direct-current output, both for continuous operation and re-establishment after a failure of the alternating-current supply. With this one limitation, which is overcome by adding one or two larger lamps to the normal switchboard pilot lamp load, it has been possible to operate the battery for several months without any adjustment. Discharges occasioned by the normal functioning of the station control apparatus are returned by the charger at a somewhat slower rate, but eventually the balance is re-established at exactly the predetermined operating voltage. The usual slight variations in alternating-current voltage apparently have no effect. The connections of the two chargers are shown in the accompanying diagram.

The original cost of such a unit is about on a par with a motor-generator set, but the maintenance is practically nothing, as the tubes have a life of several thousand hours at the low charging rate that was used.

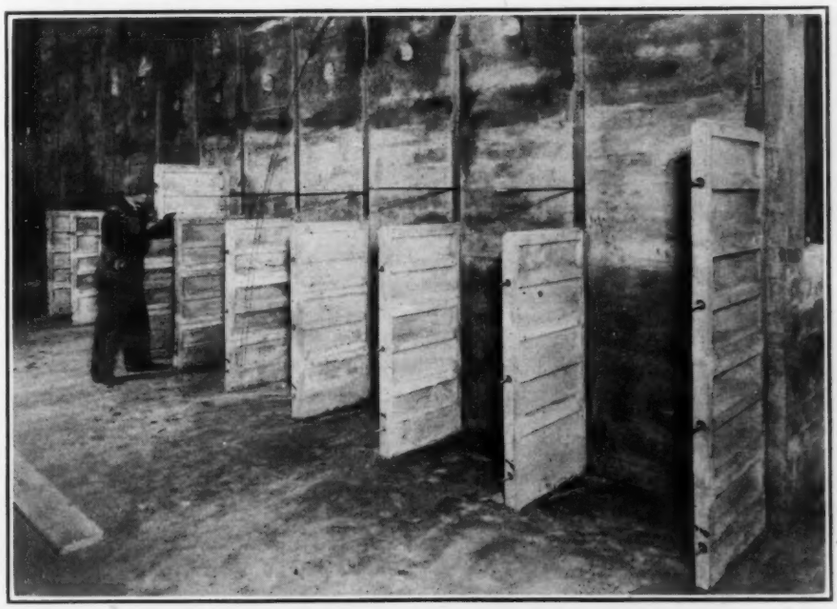
However, the very superior operating characteristics, resulting in a much longer battery life, would justify the installation even at a greater cost.

Cell Construction that Avoids Difficulties

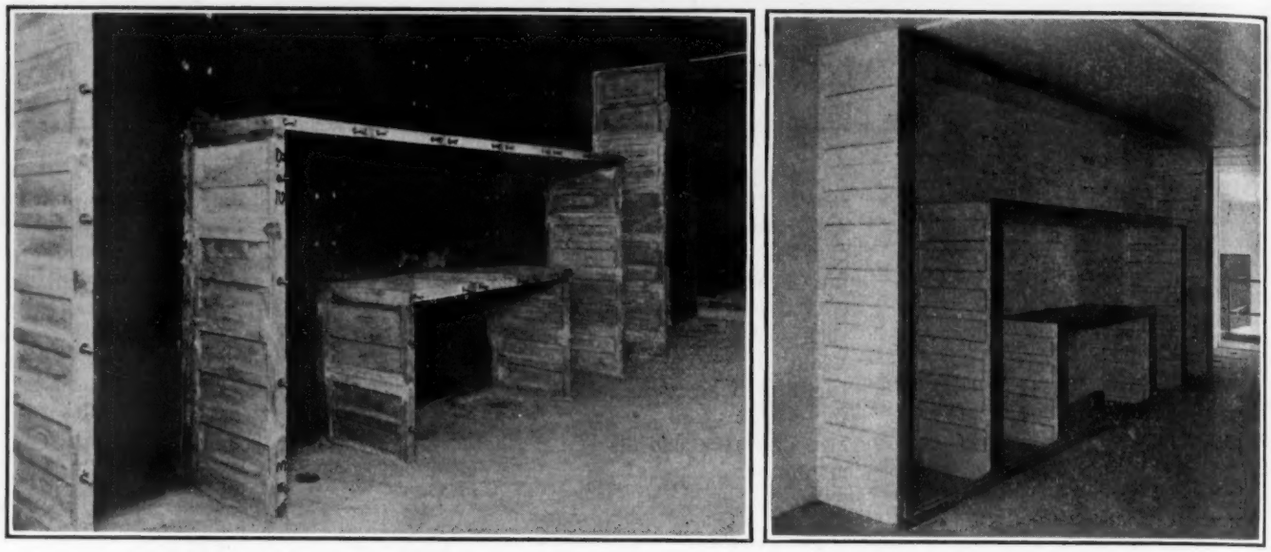
BY PAUL NICHOLAY
Electrical Engineer, Smith, Hinchman & Grylls, Detroit

TO KEEP down the cost of the initial bus and switch cell installation in the new Detroit municipal plant and in view of the prospective development of the power demands it was found desirable to install at present only that part of the cell structures which would actually be required at this time, and also to provide means for convenient and comparatively inexpensive installation of future cell structures. In doing this, the necessity of making future installations without interruption of service had to be kept in mind. It was also desired to install cell walls of such construction that they could be easily removed to facilitate eventual repairs of the electrical equipment. Considering these requirements, it was out of the question to use the conventional cell construction of masonry, monolithic concrete or gypsum. After thorough investigation it was decided to adopt pre-cast concrete-slab cell structures of a type which has recently been developed.

The cell walls are cast in steel molds and are designed to combine lightness with strength. The weight of the cell walls is about 20 lb. per square foot. The units of which the walls are built up are of such size that they can be conveniently handled by one or two men. Slabs are fastened together by tongue-and-groove joints and are individually



BUILDING UP PRE-CAST CONCRETE-SLAB CELL STRUCTURE



VIEWS OF SAME CELL STRUCTURE SHOWING HORIZONTAL BARRIERS AND ALIGNED JAMB STRIPS WHICH COVER NUTS AND BOLT ENDS

secured to the building structure by bolts extending through the full width of the slab into slotted steel inserts, placed at the bottom of grooves that are provided in the walls or ceilings, as the conditions may require.

Where cell structures of this type are to be attached to brick walls, concrete blocks provided with groove and insert are built into the walls. Proper alignment of the blocks is obtained by means of dowel pins in the ends of the blocks. These pins also serve as attachment for metal straps anchoring the blocks to the brickwork.

Horizontal barriers or shelves are constructed in the same manner as the vertical walls, except that the slabs are not paneled and two fastening bolts are used per slab instead of one. Each slab also has a continuous bracket on its under side to provide the necessary support. The horizontal barriers for bus compartments 27 in. deep were in this particular case designed for an evenly distributed load of 100 lb. per square foot.

To the front edge of the cell partitions are attached metal-covered jamb alignment strips, fastened by means of the cell-slab anchoring bolts. Finally, a jamb strip made of No. 16 gage rolled steel is screwed to the alignment strip, covering the bolt ends and nuts. The jamb strip carries the cell doors, covers and interlocking devices.

By using this type of cell construction the great difficulty of suspending barriers from the ceiling is overcome. Furthermore, all posts for the support of horizontal barriers between busbars can be eliminated, thus allowing easier inspection and repairs on bus equipment.

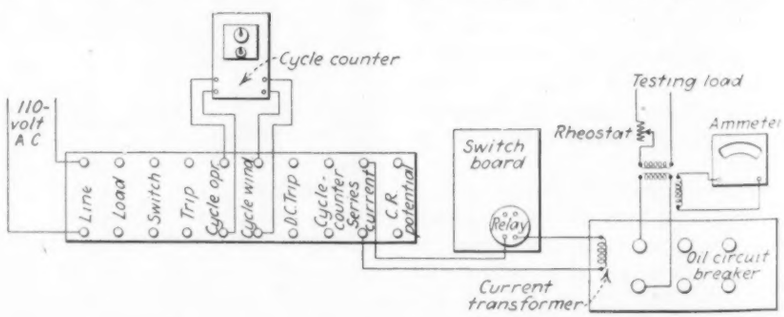
The plant for which these cells were constructed is designed for a main bus and transmission voltage of 24,000 volts. As all the switching equipment is installed indoors and all high-tension conductors are uninsulated, an extensive system of cell structures is required to inclose the buses.

The cell structures were furnished and installed by Deceleco, Inc., which specializes in the design, manufacture and installation of complete cell structures. The cell doors and covers were made entirely of "transite" with steel trim, thus eliminating any combustible material. Hinged doors are used throughout. They are provided with snap catches and specially designed Robinson interlocks. The entire installation is fireproof and is considered of very neat and pleasing appearance in addition to its construction advantages.

Timing Circuit Breaker and Relay Operation

BY J. R. HALLADAY
Meter Department, Ohio Public Service Company, Cleveland, Ohio.

IT IS frequently desirable to include the time of oil circuit breaker operation as well as that of relays and auxiliary switches when making field tests. This is accomplished with a new test set developed by the Ohio Public Service Company by the connections shown in the accompanying diagram. A current is applied to the primary of the current transformer supplying the relay corresponding to some known or predetermined value against which the relay has been previously checked. This current causes the auxiliary contacts to close and thus starts the cycle counter. At the opening of the oil circuit breaker contacts, the current in the secondary circuit is, of course, interrupted and the relay returns to its normal position, the cycle counter giving the elapsed time from the application of current to the current transformers until the



CONNECTIONS FOR TIMING CIRCUIT-BREAKER OPERATION

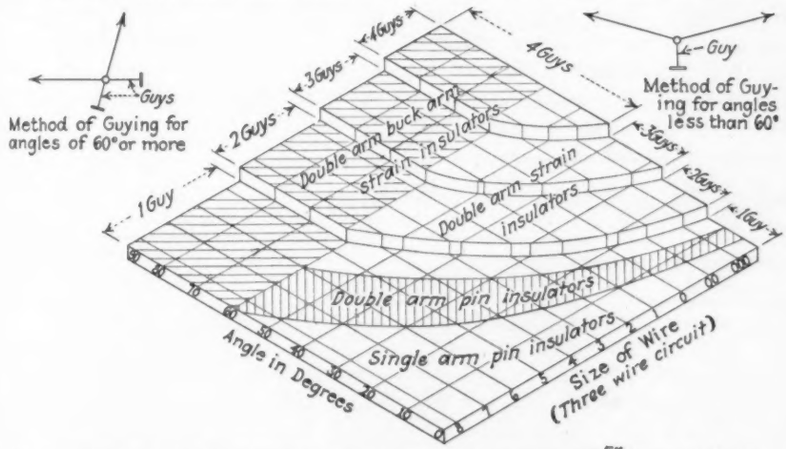
final opening of the circuit. This test is usually made on new construction and checks the time of operation and the continuity of the secondary wiring.

Guy and Framing Chart for Distribution Lines

BY EARL BAUGHN
Engineering Department, Washington Water Power Company, Spokane, Wash.

WHEN preparing plans and specifications for distribution lines the accompanying chart has been found useful by the Washington Water Power Company for determining the number of guys required and the type of framing of the pole at angle points.

The point of intersection of the lines corresponding to the size of wire and the angle in the line falls in one of the four areas, which determines the type of framing of the pole. The intersection also falls in one of the four steps of the chart, which indicates the number of guys required. For instance, a circuit of three No. 4 wires on a 30 deg. angle requires a double-arm, pin-type pole framing and one guy. The same line at a 90 deg. angle requires a dead-end, buck-arm framing with strain insulators and two guys.



The number of guys as given by the chart are the number of 5/16" Siemens Martin guys, of 6000 lb. tensile strength installed at 45° angle with the pole, necessary to balance the pull of one circuit of three wires. For buck-arm poles the chart gives the number of guys required each way

CHART FOR DETERMINING NUMBER OF GUYS AND FRAMING REQUIRED ON ANGLE POLES

Example: The intersection for any given size of wire and angle on the pole falls in one of four areas, indicating type of framing. It also falls in one of the four steps on the chart, indicating the number of guys required.

The calculations for the chart were made on the assumption that the breaking strength of a 5/16-in. Siemens-Martin guy is 6,000 lb., that the guy is placed at an angle of 45 deg. with the pole and that the number of guys as determined from the chart will hold the three conductors when each is stressed to its ultimate breaking strength. A breaking strength of 6,000 lb. for 5/16-in. Siemens-Martin guy strand is higher than the rated value, but it has been found that material supplied on recent purchases has actually shown this strength on test.

Tests made by the Detroit Edison Company and reported in the ELECTRICAL WORLD of Aug. 25, 1923, page 379, show that the breaking load of a 1¼x9x1-in. locust pin varies from 430 lb. to 870 lb. applied at the insulator groove. In making up this chart it was assumed that 500 lb. was the safe breaking load of a pin. The limit for double arm framing with strain insulators is arbitrarily set at a 60 deg. angle, beyond which buck-arm framing is specified.

Relative Merits of Thermal Relays

BY C. W. KUHN
Development Engineer Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

MANY of the evils of overmotoring in the past may be attributed to the desire to guard against overloads. Obviously it is not economical to use a motor larger than actually required by the normal load, merely to avoid overloads because of the initial investment and the increased operating cost. This situation has created a demand for a long inverse-time-element overload protection, some of the newer forms of which are of the thermal overload type.

Thermal overload protection may be divided into two general types, fuse type and relay type. The fuse type is limited to non-adjustable devices. Change in current rating occurs in steps that do not always fit the specific motor for which they are used. Where frequent tripping may be expected, the fuse type is never quite satisfactory. When using this type, it is necessary to employ a larger motor than might be used with a more satisfactory protective device.

There are two kinds of thermal overload relays, adjustable and non-adjustable. The non-adjustable relay has the same limitations regarding the motor current rating as has the thermal fuse. In addition, manufacturing inaccuracies occurring in this type cannot easily be compensated in actual use. Inaccuracies that cause the device to trip at a lower current than that at which it is rated lead to the choice of a protective device of higher rating. This results in the use of a larger motor than necessary to carry the load so that the motor be protected.

Adjustable thermal relays can be subclassified into three general divisions according to their principle of operation—namely, expansion of metal, bimetallic and change of state. Since the expansion of metals is small per unit of length, protective devices utilizing this principle require considerable multiplication of the movement. Any subsequent wear or change causes noticeable inaccuracies. Because they utilize the expansion of metal in a somewhat different way, bimetallic relays are, in general, more satisfactory than those using the simple expansion principle, although friction is frequently the cause of inaccuracy.

Thermal relays that depend upon "change of state" for their operation minimize one great cause of error in thermal devices—namely, temperature. One type depends for operation on liquid-to-gaseous conversion and another type on solid-to-liquid conversion. The first type is affected to some extent by variations in pressure which cause variations in tripping temperature.

Thermal relays depending for oper-

ation on solid-to-liquid conversion can readily be made very accurate if the proper material is used. The greatest error would then be due to the heater. This error, however, is inherent in all thermal devices. Manufacturers of resistance material will furnish material for heaters that varies plus or minus 5 per cent. As the variation in current due to this cause varies with the square root, the probable error is quite small.

The more accurate the protective device the closer the motor application can be made without danger of burnout or of frequent tripping. The tripping temperature should approximate the danger temperature of the motor. Under these conditions and with motor and starter subject to the same temperatures, the overload will compensate for varying ambient temperatures. Protective devices the tripping temperature of which is too low will not permit the motor to carry its maximum safe load when placed in high ambient temperatures. On the other hand, if the tripping temperature is too high, they will permit the motor to burn out under these conditions. With low ambient temperature the reverse is true.

Current adjustment by varying the tripping temperature is very undesirable for the reason that variation of 50 per cent in tripping current would mean a variation in temperature rise of more than 2:1, as this varies as the square of the current.

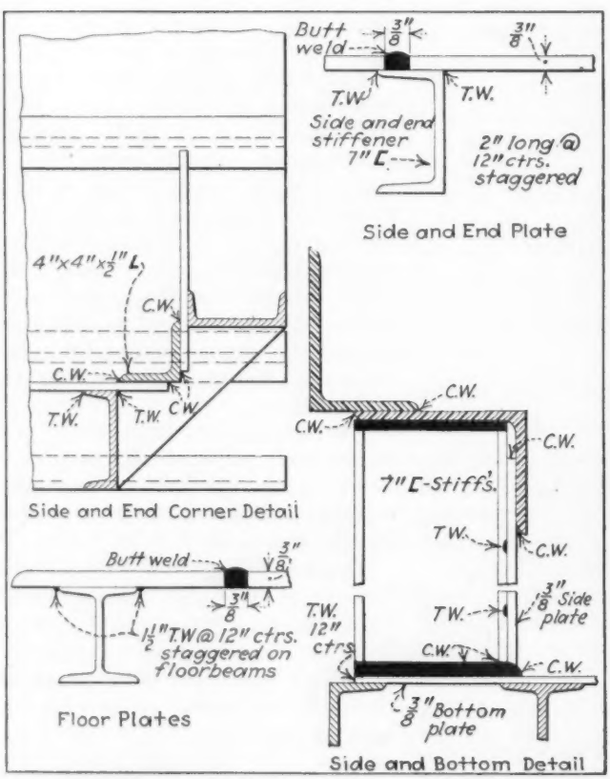
Successful Meter School in Alabama

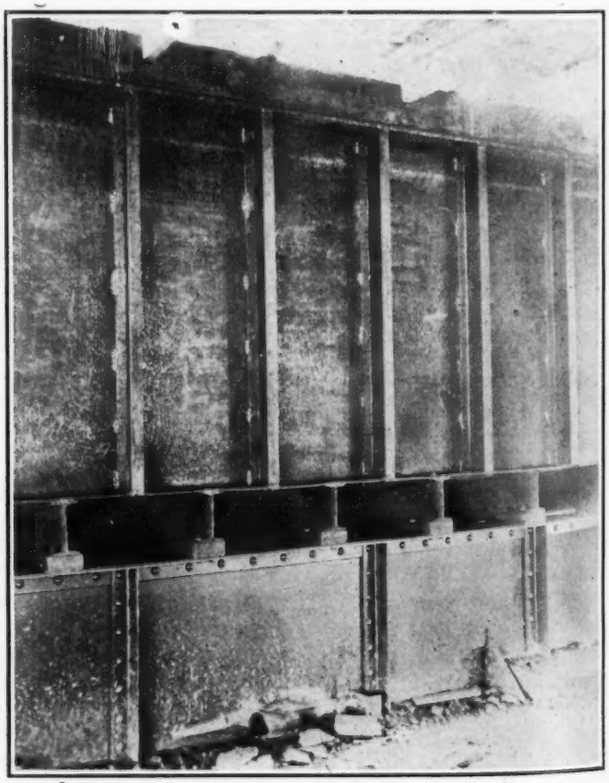
WORKING in co-operation with the Southeastern N.E.L.A. meter committee, the Alabama Polytechnic Institute gave a very successful short course in metering at Auburn, Jan. 11 to 15. It was widely attended and was considered one of the best that had ever been given in the South. Both single-phase and polyphase metering were studied, including not only methods of testing but also methods of connecting meters with instrument transformers. Various ways of verifying connections were also studied. Work was begun at 8 o'clock in the morning and continued until between 8 and 9 o'clock in the evening, with an hour's intermission for lunch and another for dinner. Each man enrolling chose certain subjects he wished to study and was assigned hour by hour thereafter to recitations, lectures and laboratory work, so that at all times the entire school was running on schedule with every man assigned to some definite task.

A great deal of assistance was supplied by the meter manufacturers not only by the apparatus which they exhibited but also by personal instruction in charge of recitations. The entire school was in charge of Prof. A. St.C. Dunstan, professor of electrical engineering, who was ably assisted by Professor Hill and others of his staff.

A meeting of the meter committee of this geographic division was also held at Auburn during the week, which added to the attendance and interest. Men attended the school not only from Alabama but also from Georgia, North Carolina, Tennessee and Mississippi. About fifty seniors took part in the school and attended as many lectures as possible. It is expected that another school will be held next year.

Swimming Tank Electrically Welded





ARC WELDING demonstrated its economy over rivets in the construction of a swimming tank at the Standard Club, Chicago. Plates except those requiring bending were shipped direct to the job from the mill. In the construction of this tank there were used 1,350 ft. of continuous welding, 350 ft. of 2-in. tack welding at 12-in. centers and 960 ft. of 1½-in. tack welding at 12-in. centers. The amount of welding wire used was 800 lb. and the thickness of plate was ⅜ in. The line drawing illustrates various classes of welding on this job and the photograph shows floor beams, stiffeners and plates in place. The Graver Corporation, East Chicago, Ind., was the contractor.

Commercial Activities and Public Relations

Flat Charge for Connection Aids Range Sales

DEVELOPMENT of the electric range load in some localities has been retarded by what appears to the user excessively high costs for wiring and installation. To overcome this handicap C. F. Farley, vice-president in charge of appliance sales for the Kansas City (Mo.) Power & Light Company, has arranged with several electrical contractors to install and connect up ranges at a flat price. Following are the specifications for range installations:

Up to and including 6.5-kw. ranges, $30.
No. 6 wire entrance.
No. 6 wire from meter to range.
Sixty-amp. switch.
Square D switch box.

For ranges larger than 6.5 kw. specifications are the same except a No. 4 wire entrance is used and the price is $35. If a switch box is already installed, the contractor may use it or if necessary install one of sufficient capacity.

Ability on the part of salesmen to quote a flat price for connection has proved of considerable help in closing sales and the Kansas City Power & Light Company now has on its lines nearly 5,000 electric range users.

Decentralizing Field Service

BEFORE this year the Electric Light & Power Company of Abington and Rockland (Mass.) had all meter reading done by men handling no other work; service and trouble calls were cared for by general troublemen; salesmen covered the entire territory of the company, and so did collectors. To obtain a more personal relationship between employees and customers, a new district representative plan was put into effect Jan. 1, under which a decentralization of functions has been initiated.

Under the old arrangement it was felt by the management that there was danger of the work of each field man becoming too mechanical or at least rather impersonal. Such men covered too wide a territory to build up much acquaintance with individual customers, and it was felt that if a field man did not know customers and their varying conditions and needs, he could not give them individual and intelligent attention and service.

With the new plan nine representatives have been assigned, each to a district of about 800 customers. The varied duties of the specialized workers listed above have been placed upon the shoulders of each of the district representatives. The first task of each will be to read from 30 to 40 meters a day. In connection with this work, the representative will make minor repairs to appliances, demonstrate and sell new appliances, investigate complaints as to service and bills, and in general handle public contacts with the company on a responsible basis. It is believed that by this arrangement the public will better individualize the company.

Afternoon Show-Window Lighting

BY M. L. CUMMINGS, JR.
Utah Power & Light Company,
Salt Lake City

THE value of afternoon show-window lighting, both from the viewpoint of the merchant and from that of the central station, was effectively demonstrated by the Utah Power & Light Company during the month of December. The idea was

National Advertising to Build Up Load

UTILITY managements will admit very freely that the health and well-being of their properties are inseparably bound up with the growth of the communities which they serve. Not frequently, however, do they take any constructive action in the matter, being apparently satisfied to do only what Mark Twain said people did about the weather. But there are occasional instances where a utility has departed from the usual course and has made consistent and determined efforts to build up business by expatiating on the merits of its territory to the industries of the country at large.

Industry depends largely upon transportation, raw material, labor of the right type, and dependable, economical power.
Manufacturers in Georgia find raw material of many kinds, either at their door or within easy reach. They find an ample supply of the very highest type of Anglo-Saxon labor. They find hydro-electric power as dependable in its constancy as can be found in any section. Manufacturers, who have investigated the industrial possibilities of Georgia, know that, when developments either already under way or that will be started within the current year are completed, the power supply will be far in excess of the demand. But no sooner will these projects be completed than work will be started on others.
Georgia offers much to manufacturers of many lines. We will gladly send you complete information.
Georgia Railway and Power Co.
ATLANTA

ONE IN THE GEORGIA RAILWAY & POWER COMPANY'S SERIES OF NATIONAL ADVERTISING

This was done very effectively during the past year by the Georgia Railway & Power Company. A series of advertisements — one is here reproduced — were run consecutively in 1925 in a number of the trade journals of different industries as well as in general industrial and business publications. These advertisements, although not in every case definitely mentioning electric power, always suggested it by decorations of hydro and steam plants, transmission towers, street cars, etc.

The text of the advertisements enlarged upon every factor of natural and man-made conditions that had a persuasive value.

brought to the attention of its commercial flat rate window-lighting customers in Salt Lake City by the power company by means of a letter calling attention to the fact that the greatest number of shoppers are on the streets during the afternoon hours. Particularly during the holiday season, the letter stated, when windows are at their best and the skies are usually cloudy, illumination earlier in the day will add to the attractiveness of the display.

In order to provide this afternoon lighting service a schedule was arranged under which show-window lights could be turned on at 1 p.m., instead of the regular hour at dusk. A card was inclosed showing the amount the customer was paying for flat rate window lighting and the additional charge if afternoon service was desired for a 30-day period. The company's services were also offered in handling specific problems the customer might have in regard to window lighting, such as color lighting and special decorative features. Approximately 25 per cent of the company's customers of this class in Salt Lake City adopted this service during December, representing almost every kind of downtown merchandising business.

Favorable comments were received from a number of these customers as to the value of such lighting, and its use will undoubtedly be more extensive and cover longer periods as a result of this satisfactory experience.

The company derived additional revenue of approximately $9.60 per customer for the month from this class of business.

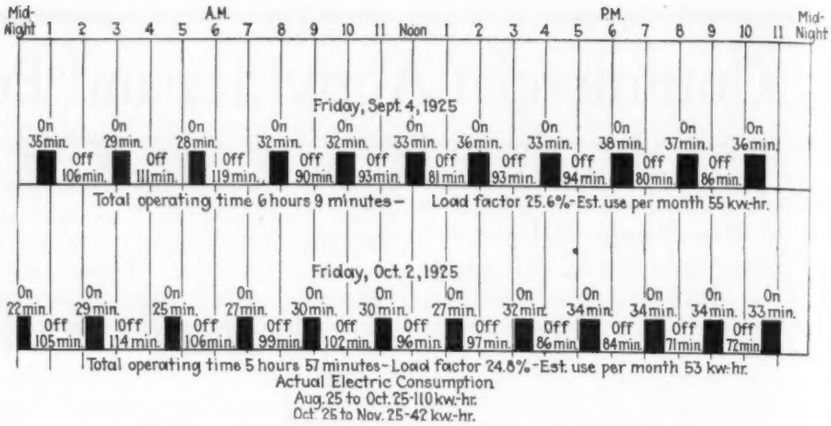
Sell 170 Refrigerating Machines in Seven Weeks

THE "New-Business Bulletin" of Henry L. Doherty & Company records the sale of 170 Frigidaire ice machines in seven weeks by the Durham Public Service Company of Durham, N. C. The 1920 census gives Durham a population of 21,719. The accompanying table presents an analysis of the campaign.

Each vertical column represents the work of one salesman, except the last, which is the total.

Domestic units	41	9	32	26	35	143
Commercial	11	9	1	1	5	27
Total	52	18	33	27	40	170
Sales in dollars	18,396	7,001	13,109	8,462	13,989	60,957
Domestic customers called on	1,095	1,095	1,095	1,095	1,095	5,475
Commercial customers called on	286	286	286	296	286	1,430
Total customers	1,381	1,381	1,381	1,391	1,381	6,905
Per cent of total customers sold	3.76	1.03	2.39	1.95	2.89	2.46

Estimated yearly consumption increase, 193,500 kw.-hr.
Estimated yearly revenue increase, $16,776.


Mid-Night 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11 Mid-Night
A.M.
P.M.
Friday, Sept. 4, 1925
On 35 min. Off 106 min.
On 29 min. Off 111 min.
On 28 min. Off 119 min.
On 32 min. Off 90 min.
On 32 min. Off 93 min.
On 33 min. Off 81 min.
On 36 min. Off 93 min.
On 33 min. Off 94 min.
On 38 min. Off 80 min.
On 37 min. Off 86 min.
On 36 min.
Total operating time 6 hours 9 minutes — Load factor 25.6% — Est. use per month 55 kw-hr.
Friday, Oct. 2, 1925
On 22 min. Off 105 min.
On 29 min. Off 114 min.
On 25 min. Off 106 min.
On 27 min. Off 99 min.
On 30 min. Off 102 min.
On 30 min. Off 96 min.
On 27 min. Off 97 min.
On 32 min. Off 86 min.
On 34 min. Off 84 min.
On 34 min. Off 71 min.
On 34 min. Off 72 min.
On 33 min.
Total operating time 5 hours 57 minutes — Load factor 24.8% — Est. use per month 53 kw-hr.
Actual Electric Consumption
Aug. 25 to Oct. 25 — 110 kw.-hr.
Oct. 25 to Nov. 25 — 42 kw.-hr.

DAILY PERFORMANCE GRAPHS OF ELECTRICAL REFRIGERATOR

Machines were installed on free trial in customers' homes and virtually sold themselves. Before installation all machines were thoroughly inspected and frozen up, so that deliveries were made with the machines ready for instant use. The salesmen were assisted in the campaign by sales and service representatives of the refrigerator manufacturers.

In connection with this refrigerator campaign in Durham one should be interested also in the accompanying graph, taken from the same source and which is self-explanatory.

Accounting for Truck Stock

Truck Drivers Act as Assistant Storeroom Keepers and Truck Stock Is Considered Part of General Stock, Being Charged to Truck Until Issued for Specific Job

BY JAMES H. MACBETH
Purchasing Agent and Superintendent of Transportation
Southwestern Gas & Electric Company, Shreveport, La.

TRUCKS of small utility companies in a day's work may have to cover different jobs, including construction, maintenance and service work. For this reason it is practically impossible to estimate the proper amount of material to be drawn out of stock each day and the tendency is to figure high in order to have sufficient material on hand without waiting for special rush requisitions on stores. Materials reclaimed from the lines may often be used on other work orders without crediting or charging the proper account and there may be considerable waste and loss of material and improper charging against the account.

The Southwestern Gas & Electric Company, Shreveport, La., has adopted a system whereby the driver of the truck acts as a storeroom assistant and the material on the truck is considered part of the stores to be accounted for by the driver. The materials are requisitioned in the usual way, drawn from stock and charged to the truck. On the job the truck driver issues the required material, charging it to the proper work order or account. He credits his truck stock for material reclaimed or "pick-ups" from the lines, and receives credit for all material returned to the general storeroom. As a result the construction foreman is free to exercise his chief function, which is supervising the work.

To overcome the usual objection, "I was hired as a driver and not a bookkeeper," the drivers were paid a small increase over the usual driver's wages, with the understanding that they would conscientiously act as clerks in checking the material received and issued. As a further incentive to be accurate, discrepancies in the weekly truck material balances are posted opposite the

driver's name at the warehouse from which all trucks radiate. To make it convenient for the chauffeur of each truck to act in a clerical capacity, each truck is fitted with a rough but serviceable desk with facilities for keeping records.

The records required in this system include: (a) material requisition issue; (b) daily material and labor report; (c) credit slip; (d) weekly wagon stock records; (e) daily wagon stock record.

The material requisition issue slip (or usual stores requisition) is made out in duplicate to indicate the amount and kind of material, the work order or account number and the class of work to be done, if possible. The truck number is always indicated for charging the material specifically until used. A daily material and labor report is one of the most important forms, indicating the material used, location and description of the work and the work order number or account number. This report is checked by the stores clerk against the weekly wagon stock record and sent to the stock ledger department, which enters the materials and work order or account number on the disbursement sheets, thereby crediting the stores account. By charging off all materials used daily the stock ledger records are kept up to the minute, affording a perpetual inventory. To account for material returned to stores from the truck, a credit slip (in duplicate) is issued.

From the information on the foregoing forms or records the "wagon stock record" can be made up—that is, the issue or charge, the credits and the use. The remainder, if any, is the stock left on the truck, which is checked and inventoried at the end of each week by the stores department. To keep an accurate check for each truck, a "weekly wagon stock" sheet for each truck is kept by the stores department and in case there are discrepancies in the records a report is sent to the electric department for checking. A "driver's wagon stock" daily record resembling the weekly report has also been adopted so that the driver can check the material on his truck daily and the items which are carried forward from each sheet to the next succeeding one. When the balance on the weekly report is correct, the report is sent to the stock ledger clerk, who enters the corrections if any on his ledger, thereby balancing all entries previously made from the daily reports of disbursements and credits.

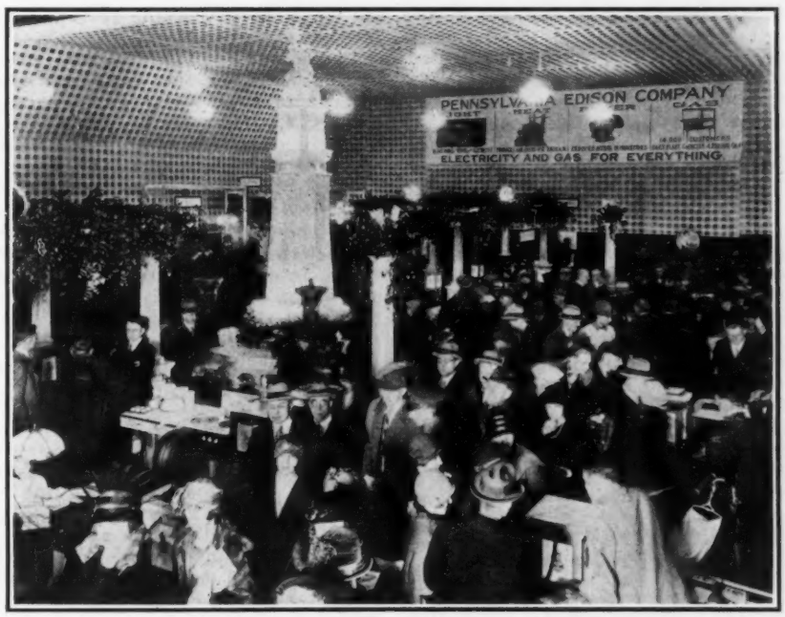
The forms and system described are the foundation of the loose-leaf stock ledger kept in the main office under the supervision of the purchasing department. The left side of the ledger is devoted to purchase and stores records and the right side to stores disbursements and perpetual inventory. On the stock disbursement side of the ledger are indicated the date of issue, account numbers, work order number, total issue, amount, quantity balance and average unit cost. This system differs from others, since stock disbursement credits are made from daily reports of the material used made out by the department using the stock. In this way the actual stock used is credited to the stores account daily, thereby keeping the stores or perpetual inventory up to the date of actual use.

Electrical Exhibition Held at Easton, Pa.

DURING the week from Jan. 23 to Jan. 30 inclusive the Pennsylvania Edison Company, in co-operation with the local electrical contractors and dealers, put on an elaborate electrical show at Easton, Pa. This company does not engage in merchandising, and it is using the electrical show idea in order to obtain and hold the co-operation of dealers and contractors. The exhibit of the power company included educational displays on all types of electric metering, fuse replacements, house wiring, care of appliances, illumination and virtually every application of electricity in the home. Tickets for the show were distributed by the electric companies and by the dealers and admittance was by ticket only. In order to stimulate attendance each ticket was numbered, and every afternoon a percolator and every evening a waffle iron were presented to the holder of the lucky number.

The show was well advertised by newspaper publicity, and during the time it was running the streets leading to it were specially illuminated and band concerts were given every evening in the public square. One feature of the show was the house-wiring exhibit, which featured the wiring and installation of fixtures in a six-room home for $59. The daily attendance at the show was more than three thousand, and it is estimated that the total attendance for the week was more than twenty-five thousand.

The Pennsylvania Edison Company is controlled by the W. S. Barstow Management Corporation, and the electrical show idea was carried out at another of its properties, in Reading, Pa., from Nov. 14 to Nov. 21, 1925. Still another show will be put on at Binghamton, N. Y., from Feb. 20 to Feb. 27. Nearly all of the fixtures and permanent company displays of the Easton show were used at Reading and will be used again at Binghamton.



THE ELECTRICAL SHOW WAS POPULAR IN SPITE OF THE COLD WEATHER

Digest of Electrical Literature

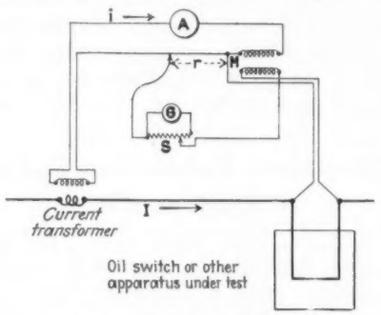
Hydro-Electric Developments and Steam Equipment

Design of Cooling Towers.—J. VASSILLÈRE-ARLHAC.—The condensation of exhaust steam in modern steam power plants requires a very large cooling equipment where a constant flow of fresh water is not available. It is customary to provide in such cases so-called cooling towers, through which the hot water is made to descend against a rising stream of air. The author presents in this article a theoretical examination of this problem, which leads to a graphical and mathematical method of dimensioning such towers for a given amount of water and the desired temperature gradient. An actual example reduces the writer's formulas to concrete facts. The employment of electrical remotely indicating thermometers is recommended as a means to gain permanent control of the proper performance of these towers.—*Revue Générale de l'Electricité*, Jan. 2, 1926.

Power-Station Efficiency in Great Britain.—From time to time operating data have been given in this publication on the more important stations in Great Britain. The present article is the twelfth of the series and deals with the St. Marylebone Borough Council Electricity Department. This is in a purely residential district in the West End of London. Seventy-four per cent of the consumers are obtaining supply at 25 per cent below and a further 14 per cent at 16 per cent below pre-war prices, and the remainder at or about the same. The rated capacity of the plant is 45,000 kw., the largest and newest unit being a 12,500-kw. set. The maximum load last winter was 28,003 kw., and the output for the year ending March 31, 1925, over 59,000,000 kw.-hr., with a fuel consumption of 2.84 lb. per unit of output. The calorific value of the coal was 10,232 B.t.u. The undertaking has a large lighting, heating and cooking load. The daily and annual load curves reflect this condition, the former by their constancy around 17,000 kw. from 9 a.m. to 3 p.m., with an evening peak rising to 27,000 kw., in the winter and their steadiness around 8,000 kw. from 9 a.m. to 10 p.m. during the summer, the latter by the great winter peaks and summer valleys. The paper includes other statistical data and curves.—*World Power*, December, 1925.

Generation, Control, Switching and Protection

Measurement of Energy Loss in Large Oil Switches.—B. G. CHURCHER and C. DANNATT.—Measurement of the power loss in switches for large currents is not practicable with the ordinary portable wattmeter, even with the aid of a suitable current transformer, because the voltages involved are too low. Laboratory tests are also precluded because of the size of the apparatus to be studied. A method has been devised which, it is stated, can conveniently be used in a works testing department. In the figure the testing current is passed through the switch and through a current transformer. The secondary current from the latter flows through an ammeter, the primary winding of a continuously variable astatic mutual inductance M and a slide wire r. G is an alternating-current detector—thermo-galvanometer or vibration galvanometer, with adjustable shunt S. Potential leads are brought from the switch to the secondary of M and the slide wire. The potential difference across the switch is balanced against the potential difference tapped off from the slide wire and the secondary emf. of M by adjusting r and M for zero deflection on G. It is shown that the effective alternating-current resistance of the switch is then $R = I/R\ (r \cos \delta - \omega M \sin \delta)$, where I is



SET-UP FOR ENERGY LOSS OIL SWITCH TEST

the main current, R the current transformer ratio and δ its phase angle. The other quantities are indicated in the figure. This effective resistance times current squared gives the power loss. From the same test the inductance of the switch may be found. An accuracy of at least 1 per cent is stated to be attainable. Measurements on a three-phase switch for 5,000 amp. at 11,000 volts showed that the brush-contact losses were a remarkably small portion of the total losses. Actual values are not given.—*World Power*, December, 1926.

Transmission, Substations and Distribution

Dielectric Problems in High-Voltage Cables.—P. DUNSHEATH.—As this paper and the discussions on it occupy 53 pages, only the merest outline can be given here. In the first place, the phenomenon of dielectric absorption is discussed as a question of fundamental importance and as a basis for a proper understanding of dielectric losses. It is shown how dielectric resistance must be carefully defined in order to be of any value as a characteristic of cable quality or in analytical treatment, and the results of experiments are given to show that while the usually accepted absorption expression departs from the truth it can be used within limits. Experimental work on absorption in different dielectrics and on the effect of moisture and temperature on the constants is also described. On account of its lack of susceptibility to rapid atmospheric changes, celluloid was selected for this part of the research. The chart presented in this connection shows strikingly the decrease of resistance with increase either of temperature or of moisture. The law connecting dielectric resistance and temperature was found to be the same for all degrees of humidity, namely,

$$R_\theta = R_0 e^{-0.06\theta}$$

Somewhat similar in form is the relation between absorption and temperature: $I_t = I + At^{-n}$, where I_t is the current in microamperes, t minutes after the application of the testing voltage, and I is the value the current appears to approach after a long time, that is, a period measurable in hours. Numerical values for I and n are given in the paper for various temperatures and percentages of humidity. Other topics are the dependence of alternating-current losses on direct-current characteristics, the "V" curve connecting dielectric power factor and temperature, the rise of power factor with voltage, the important effect of time on the breakdown strength and the bearing which this has on the effect of surges in a system. The theoretical discussions are checked against numerous tables and charts giving the results of experimental determinations. The bibliography contains 36 titles.—*Journal I.E.E. (British)*, January, 1926.

Units, Measurements and Instruments

Properties of the Single Conductor.—CARL HERING.—This is an abridgment of a paper to be presented at the mid-winter convention of the AI.E.E., in which the author proposes the use of a unit length of a single, straight conductor as a basic unit and gives reasons therefor.—*Journal A.I.E.E.*, January, 1926.

Modern Testing of Solid Dielectrics.—R. SCHNEIDER.—To determine the suitability of a solid dielectric as a member of an electrical apparatus requires mechanical and electrical tests of the material. Very accurate and fully reliable testing methods are available for all necessary mechanical features, but the electrical testing of dielectrics has not as yet had all the attention which it deserves, and authorities do not fully agree as to the importance and the method of these tests. Puncture tests on solid insulators will give, for example, different values, depending upon the time during which the potential has been applied. Internal decomposition, due to prolonged ionization, lowers in time the electrical strength of solid materials very appreciably. Such chemical decomposition will be hastened if the material is not fully homogeneous. Inclosures of foreign substances, air bubbles, fine cracks, striæ of water or humidity veins, all represent serious faults in dielectrics, leading sooner or later to a breakdown. A microscopic examination will readily disclose such faults. The measurement of the dielectric loss angle, preferably with a Schering high-voltage bridge and the Petersen connection, followed by a vectorial representation of the result, will give valuable data for the properties of the tested material. The

author describes experiences from such tests and gives a number of special precautions which he has found to be required in order to obtain fully correct and dependable test data.—*Electrotechnische Zeitschrift*, Dec. 17, 1925.

Illumination

Fading of Colored Materials by Daylight and Artificial Light.—M. LUCKIESH and A. H. TAYLOR.—An investigation has been made to determine the relative rates of fading of colored materials by daylight and artificial light. The effects of various factors, such as illumination intensity, spectral character of the radiation, temperature, humidity, etc., have been studied. Colored silk ribbons were used for the tests. The average results of tests on 23 ribbons show that exposure to sunlight and skylight at 3,900 foot-candles for eleven hours or to skylight alone at 450 foot-candles for forty hours will cause as much fading as exposure to 500 foot-candles from tungsten lamps for 100 hours; also, that approximately equal degrees of fading will result from exposures to tungsten filament radiation for 100 foot-candle-hours, skylight for 34 foot-candle-hours, or to sunlight and skylight combined for 77 foot-candle-hours. — *Transactions I.E.S.*, December, 1925.

Electrophysics, Electrochemistry and Batteries

Comparison of Fuel for Process and Power.—This article contains a statistical table covering 34 chemical industries, for each of which there is given the quantity of fuel used per year—coal, coke, oil and gas—the primary, purchased and total power consumed, and the apportionment of fuel for power and for process purposes. From this it appears that the chemical industries consume 39 per cent of the coal and 84 per cent of the coke used in all industries in the country and that they utilize 25 per cent of the power, their share being nearly 7,500,000 hp. Though the figures are summarized from census data for 1919 and are therefore six years old, the opinion is expressed that the figures for 1925, when available, will not differ greatly.—*Chemical & Metallurgical Engineering*, January, 1926.

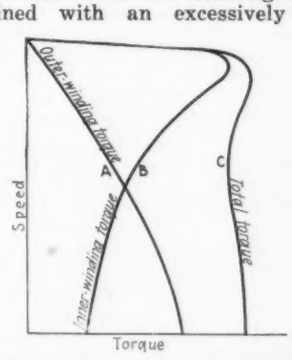
Heat Applications and Material Handling

Cranes Increase Pier Capacity Over 300 Per Cent.—For the handling of crated automobiles and steel plates two traveling and revolving cranes of the full-arch type in ratings of 0 tons and 20 tons respectively have been installed on West Shore Pier 6 in the Hudson River at Weehawken, N. J., whereby a day's work has been increased from the loading of 25 or 30 automobiles to the number of 100 to 130. The electrical equipment operates on a three-phase, 60-cycle, 230-volt circuit. The motor ratings are: Crane traveling, 60 hp.; rotating, 20 hp.; boom hoist, 30 hp.; main hoist, 60 hp.; auxiliary hoist, 80 hp. Magnetic control is provided for all except the rotating movement, motors, with interlocks where needed. Direct current for the 62-in. magnet on the 10-ton crane is obtained from a 15-kw., 230-volt motor-generator set in the machinery house on the crane.—*Engineering News-Record*, Jan. 21, 1926.

Economy of Electric Welding.—K. MELLER.—While the economies of electric welding are being recognized in widening circles, manufacturers using this welding method are as a rule reticent about publishing figures on their savings. The author of this paper presents a collection of data, gathered by unbiased experimental research work, covering electric arc welding and oxy-acetylene welding of sheet steel and boilerplate. Information is given on the current consumption, electrode consumption, gas demand, the time and the cost of the completed weld per lineal meter for various thicknesses of steel and for the two welding methods compared, i.e., gas and electric. When welding plates of ½-in. thickness or more, the angle of beveling the edge has a very great influence upon the cost of the weld. To weld two edges beveled at 60 deg. is 42 per cent cheaper than to weld the same seam with a 90-deg. bevel. The use of heavy electrode wires is less expensive than thin wires, but the bottom of a seam cannot well be reached with thick electrodes, for which reason it has been found economical to weld first with a thin wire and to finish the seam with a heavy wire. Gas welding, with its more general heating of the work piece, frequently causes warping, which it requires additional labor to rectify. The over-all cost of electric welding will be found frequently as much as 50 per cent cheaper than gas welding. The article gives many data in seven tabulations and twelve curve sheets.—*Siemens Zeitschrift*, November, 1925.

Motors and Control

Polyphase Induction Motors with Double Squirrel-Cage Windings.—C. W. KINCAID and D. F. ALEXANDER.—One of the weaknesses of the ordinary squirrel-cage motor is its low starting torque combined with an excessively high



TORQUE CURVES OF DOUBLE SQUIRREL CAGE INDUCTION MOTOR

starting current if the motor is thrown directly on the line. If the current is reduced by applying less than line voltage, the torque is still further reduced in the ratio of the square of the voltage. If, on the other hand, the rotor is made of high resistance, the torque may be increased to twice full-load torque with three times full-load current, but the running losses are large and the full-load speed may be only 80 to 85 per cent of synchronous speed. One solution, only recently introduced into commercial practice, is to use a high-resistance winding in the upper part of the rotor slots and a low-resistance, more highly inductive winding in the lower part. Owing to differences in reactance with change of rotor frequency, the currents shift from the outer to the inner winding as the speed rises, thus giving the benefit of the high-torque start and use of the low-resistance windings for running. The effect of the combined torques for a motor with an ordinary inner winding and an outer winding for good starting is shown in the figure. The maximum torque is less closely related to the current than in the general-purpose motor. With 450 per cent of full-load current it may have any value between 75 and 250 per cent of full-load value.—*Electric Journal*, January, 1926.

Traction

Java Starts Electric Trunk Line.—C. F. BALSAM.—On April 1, 1925, the first section, 42.3 miles measured as single track, of the electrified state railroads on the island of Java was opened. References to this electrification have previously been made in the Digest. The present article reviews the history of the undertaking, points out the importance of operation by means of the abundant hydro-electric power obtainable on the island rather than by fuel, which must be imported, and describes the line construction and the rolling stock. A 1,500-volt direct-current system is used, with catenary construction for the contact wire.—*Electric Railway Journal*, Jan. 30, 1926.

Telegraphy, Telephony, Radio and Signals

Progress in Telegraphy and Telephony. — W. CRUICKSHANK. — This review of recent progress in wire communication embodies a considerable amount of statistical information relating primarily to Great Britain. Superposing telegraphs on telephone circuits has been successfully accomplished between London and Penzance, London and Chester, and on circuits working in the London-Brighton cable. In machine telegraphy during the past two years Baudot circuits have been introduced as follows: One quadruplex simplex, Boulogne-Lisle; one duplex three-station, Leeds-Edinburgh-Belfast; eight duplex two-station circuits converted to three-station duplex. Carrier-wave telephony has operated successfully on selected trunk lines, but working trials of voice-frequency telegraphy have not yet taken place in Great Britain. Two such systems in use in other countries are described. Submarine telegraphy has been greatly speeded up by the use of permalloy-loaded cables. On the 2,400-mile cable between New York and the Azores, which has a uniform inductance of 54 millihenries per nautical mile, a speed of 1,920 letters per minute has been attained. Automatic telephony has made less progress in Britain than in the United States, although the whole of the Leeds area is now automatic. Other topics discussed are the matter of choice of units and the underground cable problem. A map shows existing and proposed cable lines and relay stations in Europe.—*Journal I.E.E.* (*British*), January, 1926.

New Books

The Economics of Public Utilities

By L. R. Nash. New York: McGraw-Hill Book Company, Inc. 430 pages.

This is an admirable work devoted to the economic aspects of electric light and power, gas and electric railway properties. From a wealth of experience the author analyzes and discusses the managerial problems confronting these utilities, and his task has been well and ably done. He writes of the utility companies as those actively connected with the business know them, and not as one viewing the situation professionally from afar. Naturally it is impossible to compress within a single volume an exhaustive treatise on all three utilities, but the author does give in condensed and readily understandable form an abundance of information and precept which every public utility man will welcome and keep at his elbow for reference and guidance. No engineering, commercial or general information on public utilities is included in the book; it treats solely of regulation and the rate and financial problems incident thereto. The chapters on depreciation, rate structures and securities as investments are quite to the point, and the work as a whole is of exceptional merit. W. H. O., Jr.

Superpower—Its Genesis and Future

By W. S. Murray. New York: McGraw-Hill Book Company, Inc. 238 pages, illustrated.

The very word "superpower" conjures up different ideas to different people, and any attempt to publish a book on this subject forces the author to overcome great handicaps by much labor. It is fitting indeed that W. S. Murray, one of the fathers of superpower, should interpret the present social and economic aspects of the topic, for these aspects are the most important. The engineers know and can plan the technical construction and operation connected with the development of superpower, but there must be a public understanding of the subject before much progress can be made.

The name "superpower" has been adopted and accepted by the public, and Mr. Murray starts by clarifying its meaning and by expanding its applications rather than by attempting to coin a new word. He expounds his subject by starting with the development and use of power in this country and shows how it has influenced the social and industrial life of the nation. He points out that superpower is but the realization of the best plan for getting the most nearly universal and best power service for the nation. He deals with the ownership of utilities and makes out a strong case for the private ownership and operation which have built the electrical industry in the face of all obstacles.

Briefly reviewing the superpower report of 1918, he shows what has been done to carry out the recommendations made in that early survey. One of the interesting chapters of his book deals with railroad electrification. Mr. Murray argues for a standard electrical system for the contact point and states that every system of electrification tried has been found successful. He shows that utilities should furnish power to railroads and that this would fit in admirably with the economic and social aspects of superpower.

The political aspects of the superpower situation are dealt with, including the place of the Interstate Commerce Commission, the state utilities and the national government. In the opinion of Mr. Murray, the state regulation of utilities is advisable and machinery exists for taking care of any superpower development that involves interstate questions. Superpower, Mr. Murray maintains, is a method of procedure and not a corporation, and its financing problems should be dealt with as are those of utility companies. Charts, statistical data and tabulations are included in the book.

Physik

By thirty-eight authors. E. Lecher, editor. Leipzig and Berlin: B. G. Teubner. 839 pages.

So great and so rapid have been the advances in physical science during the past quarter century that a broad survey of the entire subject is most opportune. Such a survey the work under review undertakes to present. Written by eminent specialists in their respective fields—not a few of them the very men whose researches have contributed so largely to the coming of the new era—the treatise is authoritative in the highest sense. In form it consists of a series of thirty-seven chapters or monographs, making altogether a somewhat impressive volume. In style it is historical and philosophical. The reader will find little to suggest the textbook of college days, few formulas or descriptions of experiments, but, rather, a careful tracing of the gradual development, the evolution of successive theories leading to our present state of knowledge. In objective, as set forth in the preface, it aims to give a comprehensive view of modern concepts of physics in a manner designed to appeal not only to professional physicists but to that wider circle of readers as well whose labors lie in fields more or less remote but who desire to keep abreast of current thought.

This is an ambitious and difficult task. It demands of each author that he put into a form which refrains from imposing unreasonable demands on the non-physicist the basis, the reasoning and the results of some of the most far-reaching generalizations thus far achieved by the human intellect. Evidently here is no suggestion of easy reading, though the style of most of the contributors is as simple and straightforward as could be expected in such a work. The perusal, even were the book in the reader's vernacular, would call for substantial intellectual effort on the part of any one except a keen and broadly informed physicist. But by all who can read German the effort is worth making. Moreover, the subdivision into substantially independent topics makes it possible to take up almost any one of them and thus confine the attention to a limited field of thought. As a book of reference, not a little of the volume's usefulness will be attributable to the painstaking inclusion of biographical and other dates. This spirit of thoroughness and scholarliness, indeed, pervades the entire volume.

First published in 1914, the work now appears in its second edition, somewhat revised. Some of the best known among the collaborators are F. Braun, A. Einstein, H. A. Lorentz, O. Lummer, M. Planck, E. Warburg, W. Wien and P. Zeeman. The book constitutes one number in a still more comprehensive scheme, "Die Kultur der Gegenwart." G. F. W.

Elementary Electrical Technology

By A. M. Parkinson. New York and London: Oxford University Press. 179 pages, illustrated.

This textbook for engineering students covers the direct-current circuit, the magnetic circuit, the alternating-current circuit, the oscillating circuit and units and data. Its content, therefore, conforms to the usual text treatments—but the work is very well done. The style is excellent, and the author has done a great amount of condensation without impairing the completeness or clearness of the subjects considered. The practical atmosphere is retained, yet the development of the theory is made by a direct process using the best available mathematical and graphical tools. The arrangement of illustrations and the problems at the end of each chapter are assets to those using the text material.

As is the case with many other textbooks, several topics of fundamental interest are not considered in sufficient detail. For example, while 42 pages are devoted to the magnetic circuit, only one or two pages are used to discuss the dielectric circuit. Textbooks of today should treat more thoroughly of dielectrics and of insulation and insulation compounds. On the other hand, the author in his chapter on the oscillating circuit treats admirably the generalized circuit and makes in a few pages a remarkably good presentation of the subject. The book deals with essentials and is a thoroughly good addition to existing texts. L. W. W. M.

Books Received

The Principles of Sound Signaling. By M. D. Hart and W. W. Smith. New York: D. Van Nostrand Company. 139 pages, illustrated. Price, $4.

Radio and High-Frequency Currents. By E. T. Larner. London: Crosby Lockwood & Son. 61 pages, illustrated. Price, 50 cents.

Die Transformatoren. By Milan Vidmar. Berlin: Julius Springer. 751 pages, illustrated. Price, 36 reichsmarks.

Depreciation in Public Utilities. By Delos F. Wilcox. New York: National Municipal League. 112 pages.

Economics of the Radio Industry. By Hiram L. Jones. Chicago: A. W. Shaw Company. 332 pages, illustrated. Price, $5.

News of the Industry

Amendments to Shoals Bill

Senate Eager to Transmit Power Within Economic Radius—Supplementary Legislation Probable

BY PAUL WOOTON
Washington Correspondent
ELECTRICAL WORLD

NO PROPOSAL for the disposition of Muscle Shoals can pass unless it provides for the equitable distribution of the power not needed for fertilizer manufacture within the full radius in which it can be transmitted economically. This opinion was expressed this week by Senator McKellar of Tennessee after a partial poll of the Senate.

When the House resolution providing for the joint congressional committee which is to receive bids comes before the Senate strenuous efforts will be made to amend it. If the resolution passes, as seems likely in view of the determined way in which it is being championed by the President, it seems probable that any offer made under its terms will have to provide for the use of all power not actually required in fertilizer manufacture for public utility purposes.

Even if the resolution passes, however, efforts will be made in the Senate to obtain action along different lines. It is becoming more generally known that there is no need to dispose of the power structures at bargain prices. Legislation will be introduced vesting the Federal Power Commission with the responsibility of allocating all power. A portion of the revenue derived from the power under this legislative proposal would be used under the direction of the Secretary of War and the Secretary of Agriculture for experimental work on nitrogen fixation processes and on other fertilizer ingredients. Those favoring legislation of this type feel that the uncertainties of fertilizer manufacture are such that no desirable offer is likely to be forthcoming for the nitrate plant alone. Experimentation with fertilizer processes may not be confined to government activities, as one bill provides that opportunity be afforded to properly qualified individual inventors to use the facilities for experimentation.

Dispute Over New York Water Power Still Rages

Water power continued this week to be the subject of animated debate in New York State political circles, the newspapers being full of interviews and editorials supporting or opposing the proposed action of the state Water Power Commission involving the lease for fifty years of the state-owned sites on the St. Lawrence and lower Niagara Rivers. Most of the disputants were ranged according to their political affiliations. In the Legislature at Albany Maurice Bloch, minority leader of the Assembly, introduced a resolution on Monday wherein the Assembly requests the Water Power Commission to postpone action on the applications now pending before it for development of these sites until the report of the Hughes committee on reorganization of the state government is received and until such further time as the Legislature may act upon that report.

The resolution asserts that it is rumored the report of the Hughes committee will contain a recommendation that the present Water Power Commission be abolished and its duties transferred to the Conservation Commission, refers to the message of the Governor on power development and tells of an alleged storm of protest throughout the state against the proposed action of the commission in leasing on long-term periods the Niagara and St. Lawrence river powers. The resolution was referred to committee.

Speculation was indulged in by the newspapers over Governor Smith's invitation to Owen D. Young, chairman of the board of the General Electric Company, to confer with him on the water-power question. Mr. Young was the guest of the Governor for three hours on Monday evening. After the meeting Mr. Smith said that he thought Mr. Young and he were "not very far apart." Mr. Young made no comment.

Utility Conference on Co-operation with Government

"Co-operation with the government" in development of water powers under the jurisdiction of the United States was the subject of a conference called by John J. O'Brien, president of H. M. Byllesby & Company, on Feb. 6. The conference, which was held at the offices of that company in Chicago, was presided over by Colonel William Kelly, director of engineering of the National Electric Light Association. Representatives of many of the leading public utility organizations engaged in the development and use of water power attended, among these being the Insull companies, Stone & Webster, Hodenpyl, Hardy & Company, Henry L. Doherty & Company, the Pacific Gas & Electric Company and the Pennsylvania Water & Power Company. Colonel Kelly and C. F. Hirshfeld, chairman of the Technical National Section, represented the National Electric Light Association.

These representatives unanimously agreed on a program to be recommended to the public policy committee of the National Electric Light Association under which the problems and difficulties at present encountered by the Federal Power Commission and other public authorities, as well as private interests, will, it is believed, be eliminated or greatly reduced.

Samuel Insull on Utility Management

Assails Federal Control and Stock Speculation—Pictures Possibilities of Load Building and Interconnection—Defends Centralized Management

ADDRESSING the Boston Chamber of Commerce last week in the presence of a notable gathering of leaders of the electrical industry in New England, Samuel Insull, president Commonwealth Edison Company, Chicago, asserted that the electrical industry as a whole is remarkably free from speculative influences, that its supervision by state commissions should not give way to federal control and that unsound financial methods have no place in the advancement of public utilities. The striking advantages of interconnection and great possibilities of load building were reviewed, and a warning note was sounded against resorting to "financial" as compared with "practical" management in utility development. Extracts from Mr. Insull's address follow:

"There was invested in electric light and power, electric railways and gas pretty nearly fifteen billions of dollars at the close of last year. Of that sum nearly 25 per cent was invested in the years 1923, 1924 and 1925, and it looks very much as if its extension will continue—certainly during times of reasonable prosperity and times of reasonably cheap money. But the great factor that has led to its very rapid development in the last few years is the recognition of the fact that not only should it be a monopoly but that it is a business which, in order to get the best results, should not be limited by municipal limits or by state limits, but should be limited only by density of population and density of industrial establishments. . . .

"It is that great development, that massing of production, that spreading of distribution systems over wide areas, taking advantage of the difference in time of demand, that results in a more constant use of the investment. . . . That is the economic basis of all that goes on in connection with the massing of properties, the establishment of vast systems covering wide areas, and it is the basis of the present speculation that is going on in the junior securities of the holding companies which form the medium through which those aggregations of properties are being accomplished. . . .

"There are a great many advantages which interconnection gives. The first one is the protection of continuity of service; then, as I have stated, diversity of load and territory, resulting in

improvement of load factor and conservation of capital, and then there is the diversity of generating supply—storage water power, 'run-of-river' water power, mine-mouth steam plants and steam plants at the large load centers. Then the pooling of reserve capacity reduces the amount necessary for equal production, thus conserving capital. Another advantage is the relaying of power. . . .

"One branch of electrification must go on—that is, the electrification of the steam railroads. Only about one per cent of the steam railroads of the United States are electrified today. Of the 250,000 miles of steam railroad, I do not think there are more than 2,500 miles electrified. Steam railroads consume somewhere between 150,000,000 tons and 180,000,000 tons of coal a year in their operations. The figures of what they would require if electrified are so small and the saving is so great that I almost hesitate to quote them. These savings vary from about 100,000,000 tons of coal a year to 140,000,000 tons of coal a year.

"I do not mean to suggest for one moment that all the 250,000 miles of railroads in the United States can be electrified, but certainly, where there is great density of population, great density of manufacturing, and consequently great density of tonnage, they should be electrified. From the experience of electrification of the New Haven road, there should not be a steam locomotive running between Boston and New York today. . . . I think we are about 50 per cent electrified in this country today, and our development is probably greater on the whole than that of any other country in the world.

Answers Professor Ripley

"I would like to have something to say about the most recent publication that I have seen of the critics of this great industry. I refer to Prof. William Z. Ripley's article in the *Atlantic Monthly* of January. When I saw the announcement that he had written on the subject, I thought that, coming from such a man and such a great institution as Harvard, we should get something really constructive and suggestive. His article, from my point of view, was very disappointing. . . .

"Professor Ripley in his article has a great many things to say on the subject of the way the utility business is run. His article points toward federal control, and I do not know of anything that would produce a more chilling effect upon the electrical industry than federal control. I think there are a great many problems in connection with the exercise of state control, the difference in position where a plant in one state supplies energy for use in another state; but it would be very much better that some means should be found for solving the difficulties that exist where it is a matter of interstate business, and that administration of control should take place locally, than that it should be transferred to Washington and subject to the same class of control, with the delays that are inevitable and for which no one is to blame, when you come to deal with the multitudinous propositions of the great industry spread from the Atlantic to the Pacific and from the Canadian border to Mexico.

"In referring to the industry, Professor Ripley draws attention to some defects in connection with some parts of its corporate organization. He refers to the growing tendency to take voting control out of the hands of the owners and put it into the hands of a few promoters. I am afraid that he must have drawn for his experience on what some of his acquaintances do, in Wall Street, New York, and State Street, Boston. He certainly could not have been familiar with the more conservative methods that are exercised in La Salle Street, Chicago.

"I have some right to speak on this subject. It is my privilege to operate properties that have upward of a thousand millions of issued securities in the hands of the public and that have to go to the public every year for from $135,000,000 to $175,000,000 of new capital and that have a gross revenue—electric, gas, interurban railways and a few street railways—of somewhere between $230,000,000 and $250,000,000 a year. There is not a single case, except where there is a subsidiary company all the stock of which is owned by a holding company, and therefore the securities are not in the hands of the public—there is not one single case in all the properties that I operate where I rely upon my control, my means of a voting control.

"The Commonwealth Edison Company of Chicago has 42,000 stockholders. The article in the *Atlantic Monthly* is fearful that people of that character will have their power taken away from them and vested in a small number of interested operators. Eighty-five per cent of those stockholders live in the city of Chicago. Every effort is made to get them to a meeting. It is harder to get them to an annual meeting than it is to sell them securities in our corporations. If we get 1,500 there, we are tickled to death and proud of ourselves.

"What does that mean? It means that people go into these properties for investment and their point of view is to leave what is well done alone. I am a great believer in ownership representation. I think the man entitled to the least representation is the man who takes the bond. I think the man who is entitled to a little more representation is the man who takes the preferred stock. I think the man who is entitled to the full control of the property during such time as the bond and interest and preferred stock dividends are paid and its property is kept up well is the man who buys the common stock. That is the basis on which I think these properties should be operated.

The Operator's Viewpoint

"I am not in sympathy with a small coterie—and they are usually banking institutions—fixing it up so that the control of a property is in the hands of a few. I do not believe in that method. I approach this subject as an operator. I do not approach it from the point of view of wanting control or financing a property. I approach it as an operator wishing to get my money at the lowest possible cost and wanting to give the very best service at the lowest possible price to the community and a get a fair return to my stockholders.

"As one of those who have had the privilege to lead to a small extent in the development of the central-station industry, I must say that, taking the results that have been achieved, on the whole, from one end of this country to the other, I feel very proud of the business I am in and very proud of the people who are in it. They are people of very high character. And, after all, what are you looking for in business? Methods of control? Machinery with which to operate that control? Or are you looking to the character of the people whom you have got to trust in the final analysis? I do not mean to say for one moment that I would deprecate any effort to establish the right kind of machinery of control, but I do say that, in the final analysis, you have to depend upon the honesty, probity and business uprightness of the people in control of the property, just the same way as you have to depend upon those characteristics in every other form of industrial or human endeavor.

Decries Speculation

"But there is another phase of this subject in which I rather agree with Professor Ripley. I am going to say something about the wild speculation that is going on at this time in certain forms of public utility securities—a subject to which, mainly by inference, I think, Professor Ripley referred. I know that here in Massachusetts, largely owing to the very conservative policy adopted as to the price at which securities should be issued, there is quite a tendency to split up public utility stock selling at a high premium into three or four to one. That is not a bad thing where it is reasonably and conservatively done, and of course it is regulated by your state commission here. But this continuously splitting up ten to one, fifteen to one, of common stocks of holding companies is a very dangerous thing. A combination of the multiplication table and the printing press will not add to the earning capacity of any local public utility property. I am glad to say that this movement has not extended to the operating companies; neither has it extended to any large portion of the business throughout the country. Simply because certain interests in Wall Street and State Street are so very speculative is not any indication that that same method of dealing with the business extends to the entire capitalization of the local public utility business. It is but a small portion of the $15,000,000,000 of invested money in the local public utility business that is involved in this speculation. Personally, I believe in the old-fashioned way of paying dividends in cash, of issuing your stock as near as you can to $100 a share, unless the state commission tells you that you have got to issue it at a premium, and giving your stockholders the benefit of subscription rights. I think in the long run, guarding against the rainy day, that that is infinitely better for the industry as a whole than the more speculative methods to which I have referred."

J. R. Crouse Gets Medal for Co-operation

McGraw Award Presented to Vice-President of Electric Refrigeration Corporation at Notable Banquet at New York Sponsored by Society for Electrical Development

MORE than two hundred well-known electrical men attended a banquet at the Waldorf-Astoria, New York, on Monday evening of this week, held under the auspices of the Society for Electrical Development, to confer upon J. Robert Crouse, vice-president Electric Refrigeration Corporation, the medal and purse given him under the James H. McGraw award.

To Mr. Crouse, formerly a prominent figure in the incandescent-lamp industry, was awarded the medal for co-operation in recognition of his long-time service in the promotion of co-operation in the electrical industry and with particular reference to his leadership in the co-operative organization of the electric refrigerator industry.

W. W. Freeman of Cincinnati, president of the Society for Electrical Development; Owen D. Young and James H. McGraw were listed as speakers, but very unfortunately an attack of illness made it impossible for Mr. McGraw to attend and an unexpected call of unusual importance took Mr. Young out of the city. Both Mr. Young and Mr. McGraw sent letters of regret in which they congratulated Mr. Crouse on his achievements and testified to the vital need for co-operative work in the development of the electrical industry and the importance of recognizing individual initiative. A letter of regret from Secretary Hoover was also read.

Henry L. Doherty was the first speaker. Mr. Doherty is an old friend of Mr. Crouse and as the first president of the Society for Electrical Development was an active worker in the early days of electrical co-operation, which he described, paying a hearty tribute to the leadership of Mr. Crouse.

Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD, outlined the scope of the three medals previously given under the McGraw award, these having gone respectively to the manufacturer, the jobber and the contractor who were held to have made the most constructive contributions for the advancement of the industry each in his own field. He then read the citations for three certificates of honorable mention awarded by the judges of the 1925 award for co-operation. These citations went to George W. Austin of Toronto, who was the originator of the "red seal" plan for the promotion of adequacy in wiring installations; to Clyde L. Chamblin, president of the California Electrical Construction Company, who has been a leader in co-operative effort on the Pacific Coast, and to John J. Caddigan, assistant to the general superintendent of the Edison Electric Illuminating Company of Boston, who adapted the electrical show idea for use in small communities and neighborhood centers.

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J. ROBERT CROUSE

The medal was then presented to Mr. Crouse, with the following citation:

"J. Robert Crouse, called the 'father of co-operation in the electrical industry' and founder and director of the Society for Electrical Development, for twenty years has been the outstanding exponent of the principle that electrical men should work together for the upbuilding of the electrical market and the promotion of the idea of 'doing it electrically.' Beginning in the vision of a co-operative publicity program for the lighting industry, his conception gradually expanded until it embraced the entire scope of electric service and the broad purpose of increasing human happiness by relieving drudgery both in industry and in the home. Under his aspiring leadership and through the sheer force of his engaging personality and his unflagging zeal, this, his dream of early days, has gradually influenced the thinking and the spirit of electrical men until it has effected a degree of co-operative achievement unparalleled in any other industry.

"It was through his initiative that 'Camp Co-operation I' was held at Association Island in 1912, which was the first conference of the foremost men of all branches of the electrical industry to discuss the possibilities of co-operation in market development, and out of this meeting came the organization of the Society for Electrical Development. Despite his retirement from the electrical industry for a number of years, his interest in the furthering of co-operation for upbuilding the electrical market never diminished, and his dynamic enthusiasm continued to win new converts and carry the movement forward. With his return to the electrical industry comes the most notable recent example of his progressive leadership, in the organization of the manufacturers of electric refrigerators into a council that, almost at the birth of this new and rapidly expanding branch of the industry, has established a high standard of harmony of purpose and a co-ordinated program of creative selling that is bringing great impulse to the development of this vital service to the American home. In recognition of this distinguished contribution to the advancement of co-operation in the electrical industry, the judges have awarded to Mr. Crouse the medal and purse for co-operation, given under the James H. McGraw award for 1925."

Mr. Crouse, in expressing his appreciation of the award, said that whatever he had been able to do for co-operation was the result of sympathy for the idea on the part of electrical men everywhere. He gave especial credit to Franklin S. Terry of the General Electric Company for his efforts at promoting the solidarity of the industry. Referring to Waldenwoods, the camp established by him at his farm in Michigan, Mr. Crouse announced that he

BANQUET TO CELEBRATE THE PRESENTATION OF MCGRAW AWARD FOR CO-OPERATION TO J. R. CROUSE

was planning an ambitious program for this second Association Island and was about to deed it to the industry in the interest of co-operation.

Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company, was called upon and spoke appreciatively of Mr. McGraw's work in bringing together diverse fields of the industry, calling him a practical philosopher and a business man with ideals. Mr. Tripp also spoke in praise of the work done by Mr. Crouse and described the Society for Electrical Development as a practical demonstration of co-operation along broad lines.

Midwinter Institute Meeting

Four-Day Session of A. I. E. E. at New York Is Well Attended and Highly Successful

AS THE ELECTRICAL WORLD goes to press the annual midwinter convention of the American Institute of Electrical Engineers is in full swing at the Engineering Societies Building, New York, with well-attended sessions and the usual profitable technical papers and discussions and enjoyable entertainment features. A total registration of 1,550 was indicated. President M. I. Pupin called the convention to order on Monday. He spoke very briefly, dwelling on the tendency of technical and scientific men, whatever their specialty, to draw closer together.

On Monday afternoon a transmission session, with five papers, was held, and on Monday evening there were three papers on dielectrics and insulation, contributed respectively by Professors J. B. Whitehead of Johns Hopkins, V. Karapetoff of Cornell and C. L. Dawes (assisted by P. L. Hoover) of Harvard. Tuesday morning the program included six papers on protection, control and bus construction, parallel sessions in the afternoon covering electrical machinery (four papers) and communication and sound reproduction (four). The paper by W. G. Baker and C. W. Rice of the General Electric Company on "Refraction of Short Radio Waves in the Upper Atmosphere" was an outstanding feature of Tuesday's proceedings. Another series of four papers on electrical machinery occupied Wednesday morning, the afternoon being given over to trips of inspection and the annual dinner-dance at the Hotel Astor occupying the evening. Electromagnetism and electrophysics supplied the topics for Thursday morning's four papers, and five papers on measurements (machinery and industrial) in the afternoon closed the technical program.

The "smoker" on Tuesday evening was highly successful, a thousand men attending. On Thursday evening the program embraced a public meeting in the auditorium, with illustrated lectures by Dr. Alexis Carrel, member of the Rockefeller Institute for Medical Research, on "Some Modern Developments of Biological Research," and by Major Allen Carpe of the American Alpine Club on "The Ascent of Mount Logan."

The ELECTRICAL WORLD'S customary digest of the papers and discussions will appear next week.

"Giant Power" Analyzed

Eminent Electrical Engineers Testify at Harrisburg Against the Governor's Plan

ELECTRICAL engineers were heard at Harrisburg before a joint committee of the Pennsylvania Senate and House of Representatives last week when the seven or eight "giant power" bills advocated by Governor Pinchot came up for discussion. H. W. Buck of New York, Dr. Paul M. Lincoln of Cornell and Dr. A. E. Kennelly of Harvard, representing the American Engineering Council, spoke in opposition to the bills. All three are past-presidents of the American Institute of Electrical Engineers.

Mr. Buck declared that some of the assumptions in the report of the Giant Power Commission are erroneous and misleading. He placed the cost of generating electricity at $110 or $115 a kilowatt, instead of $70. Plants rated at 500,000 kw., such as it is proposed to establish in the mining fields, would require for cooling purposes 1,000 cu.ft. of water a second, and there are, he said, few if any rivers in Pennsylvania which could supply it. No alternative provision for storage dams or cooling towers was contained in the report, and cooling towers for a plant of such size would be unprecedented and experimental. Mr. Buck also doubted the practicability of transmission at 225 kv., when the cost was taken into consideration. A single switch for a connecting rural line would mean the expenditure of $35,000.

Dr. Lincoln said that, while the bills might be intelligible to lawyers, much of the contents is meaningless to engineers. He said the costs of the giant power scheme as estimated by its promoters were inaccurate. No provision was included for spare lines, without which no great system could be operated. The triple division proposed—into generation, transmission and distribution—was one under which no system could be run.

Dr. Kennelly demonstrated that the development of electric power by private companies in this country is not only meeting the demand as it grows, but that the cost to the consumer is constantly being reduced. Pointing to the fact that Pennsylvania is now producing one-tenth of the electricity generated in the United States and selling it at an average rate less than that in most states, Dr. Kennelly asked on what ground the agitation for giant power rested. In Pennsylvania, according to the Giant Power Board's own report, 6 per cent of the farms are electrified, he said; in Ontario, under public ownership, only 2 per cent are electrified. The crux of Dr. Kennelly's argument was that the state cannot produce electric power more cheaply than the commercial companies and that under private ownership and operation the United States has far outdistanced European nations.

Under the guidance of Deputy Attorney-General Philip P. Wells, evidence in rebuttal was offered by James M. Seymour, a consulting engineer of Newark, N. J., and a builder of cooling towers, who disputed the figures of his opponents on the amount of cooling water necessary; by T. A. Panter, engineer in charge of operation of the Los Angeles municipal generating plant, who argued for the feasibility of long-distance transmission at high tension, and by Judson C. Dickerman, member of the Giant Power Board and an engineer for the Pennsylvania Public Service Commission, who said that the Metropolitan Edison Company's steam plant at Middletown, Pa., produced energy for $85 a kilowatt and that elsewhere the cost had been lowered to $71.

P. J. Morrissey, vice-president Penn Public Service Company and president of the Pennsylvania Electric Association, representing 54 light and power companies, dwelt on the progress being made by the companies in extending their lines and on the reductions in price, which in the last five years have amounted to 12½ per cent.

POWER BILLS ADVERSELY REPORTED

The Senate corporations committee on Monday night voted to report with a negative recommendation seven of the giant power bills. The eighth bill is in the hands of the appropriations committee.

Getting a 220-Kv. Line Across California Rivers

What it is thought will be the highest electric tran mission tower in the world is being erected by the Pacific Gas & Electric Company as a part of the company's new 220,000-volt line now being built from its Vaca-Dixon substation to Antioch. The tower, which will be at the crossing of the Sacramento River, near Rio Vista, will be 459 ft. high, rising 30 ft. higher than San Francisco's tallest building. Because the lands along the rivers at the crossing sites are low the towers have to be built unusually high.

To get its lines across the Sacramento and San Joaquin Rivers and at the same time comply with the federal government's clearance requirement for navigable streams, the company must put up five steel towers ranging in height from 269 ft. to 459 ft., two at the Sacramento crossing and three at the San Joaquin crossing. The tallest tower of the latter span will be 359 ft. Structural designs for the towers, a company publication says, were made by Walter Dreyer and D. M. Robinson, and the work of erection is being directed by E. H. Steele, all Pacific Gas & Electric engineers.

Without a splice in the wire, six copper-clad steel cables will stretch from anchorage to anchorage, 7,029 ft. across the Sacramento and 8,835 ft. across the San Joaquin. Supporting towers will be necessary to maintain the prescribed clearance height, but there is to be a single unbroken span of 4,135 ft. over the Sacramento River and one of 3,175 ft. over the San Joaquin. The line will end 3 miles south of Antioch, where the company is building its Contra Costa substation. With the new line operating at world's record voltage, it will be possible to carry directly a larger block of power to the industrial district served.

Purchases and Mergers

Important Transactions in Kansas, New York and Illinois—Numerous Small Plants Absorbed

ACQUISITION by the Studebaker interests, controlling the Illinois Power & Light Corporation, of a very substantial amount of the common stock of the United Power & Light Corporation, with headquarters at Abilene, Kan., has been announced by C. L. Brown, president of the latter organization. The United Power & Light Corporation, serving over 150 cities and towns of central Kansas and having a property valuation in excess of $20,000,000, is one of the major public utility enterprises in Kansas. Its affiliation with the Illinois Power & Light Corporation, represented in Kansas by the Kansas Power & Light Company, creates the largest public service organization now operating in the state. The new connection brings behind the Abilene organization all the financial resources of the Studebaker group, whose property holdings in the state include those of Topeka, Atchison, Wichita (street railway), Olathe and other cities of importance. No change is to be made in the operation or officership of the United organization, it has been announced. Interconnection of the lines of the United with those of the Kansas Power & Light Company will be effected when desired.

The expected consolidation of the Orange County Public Service Company, the Rockland Light & Power Company and the Catskill Power Corporation, all of New York State, under the name of the Rockland Light & Power Company, with a total capitalization of between $10,000,000 and $15,000,000, has been voted by the stockholders of the three concerns. As a result of the consolidation the company, subject to the approval of the Public Service Commission, will develop its hydro-electric facilities on the Mongaup River and provide adequate transmission facilities from the Mongaup River to its present Orange County and Rockland County districts.

The Illinois Public Utility Company has applied to the Illinois Commerce Commission for permission to consolidate and operate the following companies: Albion Electric Light & Gas, Atwood Electric Light & Power, Atlanta Electric Light & Power, Bement Electric Light & Power, Freeport Gas, Homer Electric Light & Power, Philo Light, Heat & Power, Lincoln Water & Light and Mount Pulaski Electric Light, Heat & Power.

The Cambridge-Albion Electric Company, which has been supplying electric service in Cambridge, Albion, London, Lake Ripley and surrounding Wisconsin communities, has been taken over by the Wisconsin Power & Light Company and made a part of that system.

Negotiations between the Wisconsin Power & Light Company and the village of Middleton for the purchase of the municipal transmission and distribution properties are virtually complete, the village board having voted in favor of the sale subject to the approval of the voters. The amount involved is $60,000.

The Southern Counties Power Company has been made a part of the general system of the Wisconsin Power & Light Company and will hereafter be known as District H. Communities included are Paoli, Bosco, Belleville, Monticello, McFarland, Verona, Brooklyn, New Glarus, Stewart and Blanchardville.

The sale of the Puxico Light & Water Company to the Missouri Power & Development Company has been approved by the Missouri Public Service Commission. The deal involves $20,000.

Purchase by the Kentucky Utilities Company from S. M. Jenkins of the electric transmission and distribution system at Marion, Ky., is announced by Lewis B. Herrington, vice-president of the utility company.

Permission to acquire the franchise and assets of the Fayetteville Electric Power & Light Company has been granted to the Southern Cities Power Company by the Tennessee Railroad and Public Utilities Commission.

The Public Service Company of Colorado has purchased the Brighton Ice, Light & Power Company of Brighton, Col., from M. R. Quinn and George M. Griffith and will carry on the electric distribution business formerly conducted by the purchased concern.

Projects Before the Federal Power Commission

The license of the Southern Sierras Power Company covering a project on Mill Creek in California has been amended by the Federal Power Commission so as to extend the completion of certain parts of the project by one and two years respectively. The time for completing the project of A. E. Humphreys on Goose Creek in Colorado has also been extended until Nov. 1.

The Ojai Irrigation District of California has applied for a preliminary permit covering a 5,000-kw. project on Sespe Creek and the Ventura River in Ventura County, Cal. It is proposed to erect a dam 180 ft. high in Sespe Creek. The water would be carried 8.2 miles in a conduit to the power house. This application conflicts with that of the Ventura Power Company.

The license issued the San Joaquin Light & Power Company covering a development on the North and West Forks of Kings River has been amended so as to exclude the West Fork from the project until storage rights have been secured. An upper development on the North Fork has been added to the project with the approval of the commission.

The commission has approved the transfer to the Pacific Gas & Electric Company of the license issued J. W. Preston, Jr., of San Francisco for a project on the North Fork of the Mokelumne River. The preliminary permit held by Mr. Preston covering a project on the Mokelumne River and Sutter Creek has been extended until Oct. 25. A similar extension has been granted the West Virginia Power Company of Charleston, covering a project on New River. The permit of the Southern Idaho Land & Power Company has been extended until Jan. 2, 1927.

Commission Rules Attacked

Illinois Electrical Association Says that Overhead-Construction Order Is Uncalled For

DETAILED objections to the tentative rules for overhead electrical construction in a proposed General Order No. 115, promulgated by the Illinois Commerce Commission, have been filed by the Illinois State Electrical Association through a committee of which R. S. Wallace, vice-president Central Illinois Light Company, is chairman. The rules and the objections to them bear on a matter of interest to all light and power companies.

In the association's brief each rule is discussed separately and in detail. Briefly summarized, the brief maintains that the proposed rules will increase the cost of construction, that the minimum loading and strength requirements are excessively severe for Illinois conditions and that the rules will prevent economical grading of lines according to service requirements. The rules, it is complained, are virtually rigid construction specifications covering all lines everywhere in the state, instead of being minimum requirements for safety and service in specific situations involving crossings, conflicts and joint use. They are not based on a study and survey of Illinois conditions; they were not built up in co-operation with the utilities of the state or with the benefit of their knowledge and experience, and they will restrict the exercise of engineering judgment and initiative. Moreover, it is contended, the rules are not based on sound engineering principles governing the strength of overhead lines; many of them are incomplete by reason of missing appendices, and they will interfere with existing rights under the law. It is further asserted that the proposed regulations are "intricate, vague, ambiguous, inconsistent and open to different interpretations," that they exceed the powers of the commission and interfere with rights of management.

Except in situations involving crossings, conflicts and joint use, the brief declares, there are no special hazards from supply lines which justify state rules covering such construction. The association's brief goes on to point out that, in view of the excellent records of service and safety made by electric utilities in Illinois in the last ten years, no justification can be seen for the adoption of intricate and restrictive rules. The present investment in overhead power lines in Illinois is upward of $150,000,000, and if these lines had been built under the severe requirements of the proposed General Order No. 115, the total cost would have been increased upward of $20,000,000, or more than 13 per cent. The benefits which would accrue to the customers and the public generally would be wholly incommensurate with the additional cost, the brief declares.

The Illinois State Electric Association contends that the rules both prescribe minimum requirements for safety and service and dictate exact methods by which the lines shall be constructed. As a result, what is virtually double regulation is undertaken.

Ohio Expansion Budgets for 1926, $70,000,000

It is estimated that about $70,000,000 will be needed by electric light and power companies in Ohio for the purpose of expanding their service during the present year. Last year the Ohio Public Utilities Commission authorized the issuance of a total of $68,966,920 in securities, including common and preferred stock and bonds.

The Cleveland Electric Illuminating Company's 1926 budget reaches $10,000,000. This company is rushing construction on its new Avon station, 20 miles west of Cleveland, on Lake Erie, where the first installation will go into operation in midsummer. Betterments and extensions of distributing facilities also are planned.

The Pennsylvania-Ohio Electric Company will spend about $4,700,000 on new station construction, steam and hydro-electric transmission, distribution and miscellaneous construction.

The Northern Ohio Traction & Light Company plans a total new capital expenditure of $2,500,000. Of this sum approximately $1,500,000 will go into its light and power division. Included in the total will be $350,000 for an addition to the South Akron substation and distributing lines, various sums for extending the underground systems in all directions, new transformers and equipment, rural-line extensions and the rebuilding of lines in Akron.

A new power station, new boilers at the old plants and additional distribution facilities are planned by the Ohio-Edison Company, with an expenditure of $1,750,000. New capital totaling $1,071,882 will be needed by the Dayton Power & Light Company, to be used principally for additions to the electric distributing system, including additional substations. Extension of transmission and distribution lines and construction of new substations are planned by the Ohio Service Company, at an estimated cost of $275,000. The Northwestern Ohio Light Company will expend approximately $240,000 for building a substation, high-tension transmission lines and additions to the distributing system.

Smaller sums appropriated are: Cleveland Southwestern Railway & Light Company, lighting department, $50,000; Lake Shore Power Company, $50,000; Ada Water & Light Company, $50,000; Greenville Electric Light & Power Company, $25,000; Ohio Electric Power Company, $12,000; Eaton Lighting Company, $7,000. Other light and power companies, such as the Union Gas & Electric Company, Ohio Power Company, Ohio Public Service Company, Columbus Railway, Power & Light Company, Southern Ohio Public Service Company and Toledo-Edison Company, are planning big expenditures.

Big Program Nearly Finished, Columbus Utility Keeps On

An improvement and extension program involving the expenditure of approximately $11,000,000 will be completed by the Columbus (Ohio) Railway, Power & Light Company, this year, C. C. Slater, vice-president and general manager, announced recently. This work has been under way for two years. Other work expected to cost $3,000,000 will be started this year. The major portion of the expenditure is being made on the light and power end of the company's property. Extensive additions in this department which will be ready for use within the next few months will double the company's output of electrical energy and put it in a position to supply most of the cities of central Ohio, Mr. Slater said.

Among the most important facilities to be placed in use this year is the new 60,000-kw. Pickaway power plant, erected about 11 miles south of Columbus in Pickaway County, at a cost of more than $7,000,000, with provision for eventually increasing its capacity to 150,000 kw. at a total expense of $16,000,000. A line of steel towers, 90 ft. high, from the Pickaway plant to the outskirts of Columbus is nearing completion and has cost $750,000; a conduit and tunnel line from the Marion Road substation in Columbus to the Milo substation cost $1,750,000, and another conduit line connecting Milo substation with the Spring Street power station added to the outgo. The Spring Street station will be abandoned eventually and in its place will be built a transformer station, Mr. Slater said. The Big Walnut power station, which will be continued in use, and other power equipment owned by the company have a combined capacity of 66,000 kw. at present.

Taunton Business Men Against New Municipal Unit

Representing thirty-five of the largest manufacturers of Taunton, Mass., Harold F. Hathaway has voiced strong opposition to the Coughlin bill, which petitions the General Court for permission to exceed the city debt limit by borrowing $500,000 for the construction of a new unit for the municipal lighting plant. At a cost of $150,000, according to Mr. Hathaway, a tie-in with the Montaup Electric Company could be arranged, and this company stands ready to sell power to the city of Taunton. Even if the city decided to dispense with outside power after a period of ten years, the company is prepared to bear the expense accruing from the tie-in.

Pacific Coast Accounting Men Talk Over Problems

To consider the theory and practice of accounting methods with a view to developing material from which to compile final reports of the various committees, the Accounting Section of the Pacific Coast Electrical Association held a general group meeting in Portland on Feb. 1, the first general meeting ever held by this section. Widespread and spirited discussion took place, among the topics canvassed being the inventory of material and supplies, transmission and distribution line records, adaptability of machines to accounts-payable records and payroll records, exchange of credit information, the application of charts and curves to statistical reports, and the legitimacy of capitalizing interest during construction. Questions having to do with the interpretation of the classification of accounts as applied to specific instances in actual operation were argued, some difference of opinion developing. It was decided that such questions should be referred to the committee on classification of accounts for judicial consideration and, if necessary, be passed on to the national committee for decision.

Briefer News

Nebraska Section, N. E. L. A., to Meet in April.—The Nebraska Section of the National Electric Light Association will hold its annual convention for 1926 at Lincoln on April 29 and 30. President J. B. Hill says that the program will pay special attention to the most recent investigations of agricultural authorities on rural electrification.

Birmingham Electric Company Has New Substation. — The Birmingham Electric Company has just completed its Red Mountain substation, built to improve service in the eastern part of the city. This is the first unit to be constructed in the company's program of supplying large blocks of power where most needed, at the same time furnishing a multiple feed-in point for the system. It contains three transformers each of 10,000 kw. rating. The station is fed by a two-circuit line direct from the Leeds substation.

Keokuk Line Now Extends 93 Miles Into Illinois. — The 66,000-volt transmission line originating at the Keokuk Dam and extending to Galesburg, Wataga, Oneida, Altona, Bishop Hill, Cambridge, Victoria and La Fafayette, Ill., is now completed. Galesburg was furnished with power last fall, but for three months workmen have been engaged in extending the system to points east as far as La Fayette. More than 900 steel towers have been erected between Keokuk and La Fayette, the distance being 93 miles.

Goose Creek (Tex.) Transmission Line Finished.—The Houston Lighting & Power Company has just finished the construction of a high-tension transmission line from its plant at Deepwater to Goose Creek, Tex., and other points at a cost of $100,000. Suspension towers carry the line over the Houston Ship Channel. The largest of these is 286 ft. in height; a second tower is more than 225 ft. high, while two minor towers convey the line to the poles. A portion of Baytown and the nearby oil fields are being supplied with electrical energy by the new line.

Bartlett's Ferry Plant Starts Up.—The first unit of the Bartlett's Ferry hydro-electric plant of the Columbus Electric & Power Company has been put in operation, according to R. M. Harding, manager of the company, and the second unit will follow it within two weeks. The first unit is furnishing 20,000 hp. and three other units to be installed will also produce 20,000 hp.

apiece, making the total capacity of the plant, when completed, 80,000 hp. This will be one of the largest hydro-electric installations in the state. Actual work on the plant began in July, 1924. The total cost of the project, when completed, is put at $7,000,000.

United Engineering Society Officers.—At the annual meeting of the board of trustees of United Engineering Society, held Jan. 28, the following officers were elected for the ensuing year: President, W. L. Saunders; first vice-president, Bancroft Gherardi; second vice-president, Lewis D. Rights; secretary, Alfred D. Flinn; treasurer, Jacob S. Langthorn; assistant treasurer, Henry A. Lardner.

Island Power Plant at St. Paul Goes on Lines of Northern States System.—The Island power plant at St. Paul, completed at a cost of $1,500,000 a year ago, has now been cut into the power system of the Northern States Power Company, which will operate it as an auxiliary of the system at a part of its capacity. The taking over of this plant results from the recent consolidation of the St. Paul Gas Light Company with the Northern States Power Company. The Island station has a rating of 20,000 kva., all of which will eventually be used, when increase in business justifies this step.

Steam Reserve Plant Called Into Service in Southern California.—The San Bernardino steam plant of the Southern Sierras Power Company has been placed in operation to relieve the load on the hydro plants in the north, according to a recent announcement by Robert Newman, district superintendent for the company. The reservoirs in the north are reported to be below normal because of the small amount of water flowing in the streams. No power shortage is threatened for next summer, however, in the San Bernardino district, officials say, since the companies have more than enough steam reserve plants to meet the demands of their customers.

Indiana Merger Will End Litigation.—One of the results of the projected merger of the Central Indiana Power Company and the Terre Haute, Indianapolis & Eastern Traction Company, announced recently by Samuel Insull in Chicago, will be the probable investment of $5,000,000 in the expansion of power stations in the Indianapolis area. Chief in importance will be the expansion of the West Tenth Street station of the Terre Haute company from a plant of 20,000 kw. to 50,000 kw. capacity. It is understood that a generating station will be developed north of Indianapolis also. These improvements, with certain changes and improvements at the stepdown station at Lenore, south of Indianapolis, will represent the added investment. The merger will end the long litigation of the Indianapolis electric light and power companies to prevent the expansion of the West Tenth Street power plant. The case now is before the Indiana Supreme Court on appeal of the two light and power companies of Indianapolis.

Five Years' Gain of Southern California Edison Well Over 100 per Cent.—A survey made by Vice-president Ballard of the Southern California Edison Company shows that the number of farms in the company's territory using electricity for irrigation in 1920 was 6,327. In 1925 it was 14,237, an increase of 125 per cent. In 1920 the generating capacity of the company was 311,800 hp. In 1925 it was 681,600 hp., an increase of 118 per cent. In 1925 the company's sales in kilowatt-hours totaled 1,567,000,000, as compared with 750,310,000 in 1920, an increase of 109 per cent. During the five-year period the number of consumers served by the company direct increased from 131,000 to 327,000 or 150 per cent. In addition to these there are more than 250,000 consumers served indirectly through energy sold for resale.

Meter Reader Who Dropped Work on Chance of Saving Stranger's Life Gets Medal.—The Insull life-saving medal has just been awarded to Charles Catron, a meter reader for the Utah Power & Light Company, whose achievement was especially noteworthy because of the circumstances surrounding it. Mr. Catron was reading meters at Iona, Idaho, when he heard that not far away a farmer had just been rendered unconscious by receiving a shock from an 11,000-volt line while hoisting a derrick. Dropping his work, Catron rushed to the place where the victim had been taken unconscious and badly burned, applied the Schaefer method of resuscitation and after eighteen minutes' effort restored the man to consciousness before the arrival of a physician.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

New Mexico Electrical Association—Franciscan Hotel, Albuquerque, Feb. 15-17. B. L. Wiles, Albuquerque.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Local Bldg., Oklahoma City.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, March 17-18. R. V. Prather, 205 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Electrical Inspectors' Association—Madison, March 17-18. A. C. Schultz, Underwriters' Exchange Bldg., Milwaukee.

American Institute of Electrical Engineers—Regional meetings: Cleveland, March 18-19; Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 8-10. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. E. T. O'Connell, Alabama Power Co., Birmingham.

Nebraska Section, N. E. L. A.—Lincoln, April 29-30. H. M. Davis, Fraternity Bldg., Lincoln.

Electrical Manufacturers' Club—Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Southern Canada Power to Sell Its Surplus Power to New Industry.—An announcement that has a direct bearing on the Southern Canada Power Company is that the American Cellulose & Chemical Company will soon built a plant at Drummondville, Quebec, expending, it is said, $7,000,000 for buildings and plant equipment. The existing supply of power developed by the Southern Canada Power Company will be adequate to provide energy for the new industry, but only a small surplus will be left, and the suggestion has been made that there may be a new hydro-electric development by the company at Spicer Falls, which is situated on the St. Francis River below the present Drummondville plant. The Spicer Falls site would be capable of producing an additional 70,000 hp. for the company.

Tecumseh Plant Ready for Expansion.—Plans to double the present capacity of the Kansas Power & Light Company's generating station at Tecumseh, Kan.—dedication of which was reported in the ELECTRICAL WORLD for Jan. 30 (page 267)—are already announced, work to begin soon. An addition to the present building to house three new boilers, the installation of another generator and the construction of several homes for employees on the power-house site, at a total expense of $1,000,000, make up the program. When it is completed the rating of the plant will be increased from 15,000 kw. to 35,000 kw., making it the largest power-producing unit in the state. The transmission line to connect with the St. Joseph (Mo.) Railway, Light, Heat & Power Company's system is almost completed, and the Kansas company will soon be supplying St. Joseph.

Great Western Power Company to Spend $11,558,000 in 1926.—Expenditures of the Great Western Power Company of California for new construction and operation during 1926 will amount to $11,558,000, according to a statement made by J. B. Black, vice-president and general manager. Two million dollars of this amount will be required for the construction of a 104-mile, 220-kv. transmission line from Sacramento to Merced, Cal., which will interconnect the system of the Great Western Power Company and the San Joaquin Light & Power Corporation. This line is now under construction and will be completed by the summer of 1926. Another item of major importance will be the raising of the Big Meadows dam and its extension from 600 ft. to 1,250 ft. This will create an additional water storage for the operation of the company's hydro-electric plants on the Feather River. The estimated cost of this work is $2,000,000. The remainder of the budget will be distributed between new substations, distribution facilities and operating expenses.

Men of the Industry

Harry D. Stokes, formerly power engineer with the Worcester (Mass.) Electric Light Company, is now connected with the Public Service Corporation of New Jersey in a similar capacity with headquarters in Newark.

H. M. Beugler has been elected a vice-president of the Central Hudson Gas & Electric Company, in charge of operating. **R. B. MacGuinness** has been appointed operating manager, and **E. R. Acker**, commercial manager, has been elected to the board of directors.

Frederick W. Lindemann, of Lindemann & Gully, has been elected a director and a member of the executive committee of the Southern Cities Utilities Company.

C. A. Mayo, district superintendent of the Malden (Mass.) Electric Company, was elected president and **A. H. Robbins**, Abington, Mass., secretary of the Electric Lines Club of New England at the recent annual meeting.

A. H. Parham has been appointed operating engineer of the Georgia Railway & Power Company, Atlanta. **C. L. Riley**, formerly underground engineer of the Georgia Railway & Power Company, has been appointed special engineer, and **C. L. Schmalmach** has been selected to succeed him in the capacity of underground engineer.

Clement C. Smith was elected president of the Mississippi Valley Public Service Company, heretofore known as the Wisconsin Railway, Light & Power Company, at the recent annual meeting. **J. P. Pulliam**, **Howard Greene** and **R. M. Howard** were elected vice-presidents and **H. C. Mackay** secretary and treasurer.

Philip L. Ross, formerly treasurer of the American Water Works & Electric Company, Inc., has been elected a vice-president of the company by the board of directors. **E. S. Thompson**, formerly assistant treasurer and assistant secretary, has been elected treasurer. **W. R. Hinchman** was appointed assistant treasurer and assistant secretary to succeed Mr. Thompson.

R. M. Houger has affiliated himself with the W. B. Foshay organization and will have charge of the Sioux Falls division of the Minnesota Electric Distributing Company and the Lamberton division of the People's Light & Power Company. Mr. Houger was formerly district manager for the Interstate Power Company of Winnebago, Minn.

Manuel V. Domenech, who has been general manager of the Porto Rico Railway, Light & Power Company for the last five and a half years, has resigned from this position. Mr. Domenech has been a prominent figure in Porto Rican affairs for many years, serving for a time as Commissioner of the Interior for the island. He expects to resume the general practice of civil engineering in the near future.

E. F. Putnam, superintendent of the New Britain district of the Connecticut Light & Power Company, has resigned his position to become president of the Greenwich Water & Gas Company. Mr. Putnam has been in the employ of the Connecticut Light & Power Company for the past thirteen years, during which time he has filled various positions in that company's system. Prior to going to New Britain he was superintendent of the Norwalk district for five years.

Farley Osgood Opens Engineering Offices in New York

Farley Osgood, for many years prominently identified with the electric light and power industry, has established consulting engineering offices in the National Bank of Commerce Building, New York, to engage in the design, construction, operation and interconnection of public utilities. Mr. Osgood will give to his clients the benefits of his broad experience in the field of electrical engineering, where as operating and designing engineer as well as central-station executive he has made a remarkable record.

FARLEY OSGOOD

A native of Boston and a graduate of the Massachusetts Institute of Technology, Mr. Osgood entered upon his public utility career as an employee of the American Telephone & Telegraph Company in 1897. He had advanced to the position of territorial manager in New Jersey before leaving the organization to become chief engineer and general manager of the New Milford (Conn.) Power Company, where he remained four years. In 1907 Mr. Osgood affiliated himself with the Public Service Company, Newark, N. J., as general superintendent of distribution. His marked ability won prompt recognition, and in a short time he was directing the production and engineering departments. The spring of 1917 found Mr. Osgood occupying the office of vice-president and general manager of the company, supervising the engineering and business activities of one of the largest light and power utilities. He severed his connection with the Public Service Electric & Gas Company Oct. 1, 1924.

Mr. Osgood has always given his time and energy generously to association work. Especially active has he been in the affairs of the American Institute of Electrical Engineers, having served on many committees, as manager 1911-1914, as vice-president 1914-1916 and as president 1924-1925. He has also been interested in the National Electric Light Association, having been a member of the executive committee of the Technical Section and its vice-chairman as well as the recipient of numerous committee appointments in that society.

Granville P. Rogers has been appointed managing director of the National Council of Lighting Fixture Manufacturers with general offices in Cleveland.

R. D. Weldy, formerly manager of the Oklahoma Gas & Electric Company at Wewoka, has been transferred to the company's Ada office in the same capacity.

W. F. Spaulding has been appointed street-lighting engineer at the Cincinnati office of the Westinghouse Electric & Manufacturing Company. Mr. Spaulding is a graduate of Purdue University.

R. A. Becker has been appointed manager of the new Paducah district of the Kentucky Utilities Company. Mr. Becker goes to Paducah from Beloit, Wis. He previously was connected with the Central Illinois Public Service Company.

H. E. Brillbart, manager of the northwestern division of the Great Western Power Company of California, has been transferred to Sacramento as manager of that division. Mr. Brillbart has been associated with the company for several years.

Carl O. Brown was recently appointed new-business manager of the Athens (Ga.) Railway & Electric Company, succeeding H. A. Pendergraph. Mr. Brown's prior connection was with the Kansas Natural Gas Company, Pittsburg, Kan.

B. H. McElhone, formerly connected with the Westinghouse Electric & Manufacturing Company, has been appointed district superintendent of the Connecticut Light & Power Company at New Britain to succeed E. F. Putnam, resigned. **J. P. Hannon**, now district engineer at New Britain, has been appointed assistant superintendent at New Britain. **J. S. Pinney**, now superintendent at New Milford, has been appointed assistant district superintendent at Waterbury, and **A. C. Bristol**, now in the engineering department at the general office, is appointed superintendent at New Milford.

James C. Morgan, manager material-handling equipment sales, Yale & Towne Manufacturing Company, Stamford, Conn., has been appointed assistant to the president. Mr. Morgan entered the organization about five years ago after seven years' service with the C. W. Hunt Company, West New Brighton, N. Y., and for a time was manager of the truck and chain block departments at Stamford. **H. J. Fuller**, assistant manager of material-handling equipment sales, has been appointed manager of this department in the Yale & Towne company. Mr. Fuller has been with the company for the past seven

years, being occupied in sales engineering work, and for twelve years was electrical engineer of the Crocker-Wheeler Electric Company at Ampere, N. J., and later with the Stamford Electric & Manufacturing Company.

R. S. McCarty has been appointed advertising manager of the Philadelphia Company and affiliated corporations. Mr. McCarty has been serving as acting advertising manager since last July.

A. C. Krachy, new-business manager for the Central Kansas Public Service Company at Ellsworth, has resigned to affiliate himself in a similar capacity with the Houston (Tex.) Electric Company.

J. W. Anderson, formerly district sales manager of the Great Western Power Company of California at Sacramento, has been appointed manager of the northwestern division with headquarters at Napa. Mr. Anderson is succeeding H. E. Brillbart, recently transferred to Sacramento.

R. L. Southwick, who for a number of years has been engaged in the sale of securities for the Puget Sound Power & Light Company and the Northwestern Electric Company of Portland, Ore., and with other electric light and power companies, has joined the W. B. Foshay organization as director of utility sales.

H. A. Pendergraph has been appointed merchandise superintendent of the Georgia Railway & Power Company, this activity being a part of the sales department of that company. Mr. Pendergraph was formerly connected with the Athens Railway & Electric Company, and prior to that connection he had been with various of the Henry L. Doherty & Company properties since 1915.

Assistant Attorney-General Lewis Goldberg of Massachusetts has been appointed a commissioner in the Massachusetts Department of Public Utilities, succeeding David A. Ellis, resigned. Mr. Goldberg was born in Russia thirty-eight years ago, was educated at the Harvard Law School and was formerly Assistant United States Attorney-General in the Boston district.

A. E. Erickson, formerly of the commercial department at Oklahoma City of the Oklahoma Gas & Electric Company, has been appointed local manager of the company at Wewoka, replacing R. D. Weldy, who was promoted to be local manager at Ada. Mr. Erickson entered the service of the Oklahoma Gas & Electric Company in 1919, after graduation from the Oklahoma University, department of electrical engineering.

N. P. Zech has affiliated himself with R. E. Wilsey & Company, Inc., investment bankers, Chicago, in their purchasing and underwriting department as vice-president. Mr. Zech has a long and varied experience in the operation and financing of public utilities. He was for ten years associated with H. M. Byllesby & Company, Chicago; for seven years with the General Engineering & Management Corporation and the Commonwealth Light & Power Company as vice-president and director, and more recently with A. E. Fitkin & Company, New York.

W. J. Bertke President of Sioux City Utility

William J. Bertke, for five years vice-president and general manager of the Sioux City (Iowa) Gas & Electric Company, has been advanced to the office of president of the company by the directors, succeeding the late L. L. Kellogg. Mr. Bertke has been associated with the Sioux City company since 1907, becoming superintendent of the plant four years after his graduation from the University of Wisconsin. He advanced steadily step by step from the ranks of the company to the position of vice-president and general manager in 1921. His long association with the Sioux City utility and his intimate knowledge of every phase of its business activities made him the natural selection for the office of chief executive.

R. A. Skinner has been assigned to the Milwaukee office of the Westinghouse Electric & Manufacturing Company in the capacity of street-lighting engineer. He was formerly with the L. B. Michaels Company of Pittsburgh, where he was engaged in public utility sales promotion work.

A. J. Mahoney, who has been manager of the Lake Superior District Power Company's electric properties in Washburn for several months, has been transferred to the main offices at Ashland. Charles Hosking of Munising, Mich., has been selected to succeed him at Washburn.

F. W. Peters, who for the past ten years has been connected with Arthur Young & Company, certified public accountants of New York and Chicago, and who for seven years has been a senior accountant, specializing in public utility audits and investigations, has entered the W. B. Foshay Company organization as assistant to the treasurer.

Jack Martin of Kenosha, Wis., has been appointed manager of the new-business and merchandise department of the Lake Superior District Power Company, Ashland, Wis., to succeed E. L. Hinchliff, who is now with the Middle West Utilities Company. For several years Mr. Martin has occupied a similar position with the Iowa Railway & Light Company at Cedar Rapids, Iowa, and for the past three years he has been with the Cribben & Sexton Company, Chicago.

Clair A. Runnals, for several years district superintendent of the Central Maine Power Company at Dover-Foxcroft, has been promoted to the superintendency of the northern division, which takes in the districts between Pittsfield and Greenville and also sections of Somerset and Franklin Counties. For twenty-six years Mr. Runnals has been engaged in the electric lighting business, first with the old Dover & Foxcroft Light & Heat Company. When this company was taken over by the Penobscot Bay Electric Company he continued in the employ of that corporation, later affiliating himself with the Central Maine organization.

F. H. Evans has been selected to succeed M. R. Frederickson as commercial manager of the Wisconsin Valley Electric Company. Mr. Frederickson has been placed in charge of the activities of the company's newly created safety first department.

George A. Donald, who has been connected for the last four years with the Lake Superior District Power Company in various capacities, has been promoted from manager of its Medford properties to general superintendent of the electric plants in Michigan at Ishpeming, Houghton, Hancock, Munising, Negaunee and numerous smaller communities. His promotion to large responsibilities is the result of a recent arrangement under which the Lake Superior District Power Company and the Michigan Gas & Electric Company were consolidated, retaining their old operating names, however. Mr. Donald's headquarters will be at Ishpeming. **C. S. Nason**, who has been connected with the general office of the Lake Superior District Power Company at Ashland as director of its public relations department, prior to which he was manager of the company's Medford properties, has been transferred to Munising. **W. Walton**, who has been in charge of the Lake Superior District Power Company properties at Mellen, has been selected to succeed Mr. Donald at Medford.

Obituary

George Newman, president of the Vallejo (Cal.) Electric Light & Power Company, died in San Francisco Jan. 4 following a brief illness.

Leonard Metcalf, first chairman of the Affiliated Technical Societies of Boston, for many years a partner in the engineering firm of Metcalf & Eddy, Boston, and a noted specialist in the field of sanitary engineering, died at his residence in Concord, Mass., Jan. 29, at the age of 55.

W. H. Robb, chief engineer of the Illinois Power Company at DeKalb, Ill., died suddenly Feb. 2. Mr. Robb was 53 years of age.

Robert A. Paine, outside plant engineer of the Brooklyn Edison Company, died of pneumonia Feb. 7 in the Methodist Episcopal Hospital, Brooklyn, after a month's illness. Mr. Paine had been identified with the company for more than twelve years and had previously been affiliated with the General Electric Company for a short period. He was 39 years of age.

Conrad W. Cooke, for many years prominent in the consulting and electrical engineering world, died Jan. 10 in London, England, in his eighty-second year. Fifty years ago Mr. Cooke introduced and made the first dynamo-electric machine (Gramme) and designed and installed the first electric light on the clock tower of the British Houses of Parliament, which is said to have been the first searchlight. He lectured at the Society of Arts in 1879 and gave the first account of the Edison phonograph. As an expert witness in electrical and other technical cases in the courts Mr. Cooke's services were in frequent demand. He was also a member of the juries of many international exhibitions.

Commission Rulings

Company Not Obliged to Serve Would-Be Patron Who Is Served by Rival Company.—The Corporation Commission of Oklahoma has determined that the Oklahoma Natural Gas Company need not serve a citizen of Sapulpa who is under contract for service from the Bartlett Gas Company, a competitor in the same territory. The would-be customer installed one meter of each company and asserted his right to be served by both. The Corporation Commission, however, took the view that this constituted a duplication of service and investment, which is economic waste and operates to discriminate in favor of such consumer as against all other domestic consumers, as the rate must be sufficiently high to give the company rendering such standby service an adequate return upon its investment.

What Constitutes Adequate Electric Service?—In denying approval of a proposed issue of stock by the Community Power & Light Company for the purpose of building a competing line in territory already served (see ELECTRICAL WORLD for Sept. 12, 1925, page 534), the New Jersey Board of Public Utility Commissioners made the following comments upon the subject of adequate electric service and of what it consists: "Adequate service not only includes voltage regulation, freedom from interruption and proper maintenance, but includes also the ability on the part of the company to take on from time to time additional lighting and power customers as service may be required by the growth or change in character of the communities. In the last few years practically all of the small electric companies of this as well as other states have been absorbed by the larger companies, the small high-unit-cost and low-efficiency generating plants being shut down. Many small water-power plants have been either discontinued altogether or supplemented by some source of primary power, and service to the communities formerly furnished from the small plants is now furnished over transmission lines from continuously operated central stations of large capacity and high efficiency."

Compensation for Meters.—The age of the meter should determine the allowance to be made to the customer upon delivery of title to the meter to the utility, and this should be determined by the number of years the customer has been obtaining service from the utility through his meter, according to an opinion by the Wisconsin Railroad Commission affecting a Two Rivers utility plant. The commission said: "Under a deferred-payment plan it is customary for the utility to make an allowance of from 25 cents to 50 cents per month on customers' bills until the amount fixed as the present worth of the meter has been amortized. In case the customer has evidence substantiating cost of meter installed on his premises different from the base cost fixed by the utility, such actual cost should be used in determining the allowance to be made by the utility."

Recent Court Decisions

Employer Responsible for Death of Clerk from Electric Shock While Attending to Duty.—In Gibson vs. Steele's Mills it was shown that a clerk in a store had been killed by an electric shock from a badly installed refrigerating plant while engaged in attending it as a part of his duty. The Supreme Court of North Carolina has sustained a verdict for damages, holding that the employer was negligent, that there was no evidence of contributory negligence or assumed risk by the employee, and that the latter when he received the shock was not in a corner of the plant where he had no duty and where the employer had no reason to suppose he might go. (130 S. E. 617.)*

Duty of Employer Who Transports Laborers in Close Proximity to Power Line to Insure Their Safety.—The Kentucky Court of Appeals has affirmed a verdict for damages because of injuries sustained by a laborer in a coal mine who was riding to work in a coal car of the company when, according to his story, the mule drawing the car came into contact with a live electric wire and ran away, causing the accident. (Horn vs. Pacific Coal Mining Company). The company's contention that the cause of injury was not proved was disallowed, the court holding that the employee's evidence that the mule was knocked down when the current was turned on, then arose and ran away warranted the submission of the case to the jury. (227 S. W. 511.)

Maintenance of Flashboards on Crest of Government Dam Held Without Legal Justification.—The Little Falls Fibre Company asked for an order from the New York State Supreme Court directing the removal of flashboards erected by Henry Ford & Son on the spillway of a federal dam near the confluence of the Mohawk and Hudson Rivers. The court granted the decree, saying that although the federal government, in the interest of navigation, could lawfully maintain the spillway of a dam in a navigable river at any height necessary for the governmental end sought, this gave no authority to a government licensee to maintain flashboards on the crest of a dam in order to improve the operation of his water-power plant, when damage to the property of others was thereby wrought. Where the plaintiffs had the right to utilize water power made available by their own dam in the Mohawk River and to have waters flow from the government dam in a normal way and without instruction by a federal licensee, it is the duty of equity, said the court, to safeguard the plaintiffs' right and not to compel them to sue at law from day to day by reason of the defendants' continuing trespass. (212 N. Y. S. 630.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Contributory Negligence in Relation to Person Absorbed in His Task.—Harry Hodgson, a workman, was seriously injured while repairing a telephone wire. Lifting the wire over his head, his hand came into contact with a power line of the Wisconsin Gas & Electric Company, 28 inches from the telephone wires when in their normal position. Claiming that the power line should not have been so close, he sued the power company, which set up the plea of contributory negligence. The Supreme Court of Wisconsin has confirmed a judgment for the plaintiff, holding that inasmuch as he was absorbed in his task the same degree of caution could not be expected from him as from a person with nothing to divert attention from possible danger and therefore the question of contributory negligence was for the jury. (206 N.W. 191.)

Right of Eminent Domain May Be Vested in Wholesale Power Company.—In Nichols vs. Central Virginia Power Company the right of the latter to condemn land was disputed, on the ground that it was not a public service corporation. The company in question is constructing and proposes to operate a power line between substations near Roanoke and Lynchburg for the purpose, among others, of supplying the Lynchburg Traction & Light Company and others with power at rates to be prescribed by the Corporation Commission. It has been held by the Virginia Supreme Court of Appeals that the furnishing of electric power by a duly incorporated company, without reservation of private benefit, to a public service corporation, which in turn furnishes the same electric power to the public, is a public use and that the corporation is properly invested with the power of eminent domain.

Proper Basis of Rate Making Again Considered by Federal Court.—The United States District Court in Missouri has found for the complainants in Citizens' Gas Company of Hannibal vs. Public Service Commission, the utility company having sued to set aside a rate decision as confiscatory. In arriving at its conclusions the court held (1) that the "fair value" of a public utility's physical property for rate purposes is the cost of reproduction less depreciation at the time in question, whether this be more or less than the original cost; (2) that "going value" is an element allowed in rate making and the evidence did not show that the sum so apportioned by the company was excessive; (3) that the value of an old plant could not be considered as a loss to be amortized merely because the company's franchise stipulated that the new plant contemplated by it should be built at another site; (4) that the commission may not disregard the operating expenses submitted, in the absence of evidence showing abuse of discretion by the utility's officers. (8 Fed. (2d) 632.)

Financial and Corporate

Utility Market Firm

Speculators Study Loan Figures—Middle West Utilities Shares Turn More Active

ATTENTION was concentrated largely on the brokers' loan figures during the week under review, with the result that the market in power and light issues, just as was the case in the market for railroad and industrial stocks, failed to develop any unusual amount of activity. In all markets, however, prices remained firm and the gains outnumbered the losses. Money conditions remain easy, the flurry in the call rate having been accepted as simply a temporary condition consequent upon the regular month-end settlements.

Renewed activity and strength in the shares of the Middle West Utilities group carried them to higher levels, the common stock rising four points during the week and the preferred and prior preferred getting also into higher territory.

Strength in the shares of Consolidated Gas Company of Baltimore lifted the price more than three points from the position of the week before on the company's continued good earnings. Commonwealth Power Corporation turned active again on reports that the earnings for early 1926 have improved substantially and that 1926 is certain to produce substantially more for the stock than did 1925 if general business conditions hold up. The stock rose about two points, and the option warrants rose to a new recent high around 75. Right to convert the options into stock expires in November this year.

Gains were shown by Mohawk & Hudson Power, American Gas & Electric, United Gas Improvement and certain of the preferred issues, whereas lower prices were recorded for Washington Railway & Electric and American Light & Traction issues.

New Capital Issues

At the close of last week the Manitoba Power Company, Ltd., made a ten-million-dollar offering of first mortgage 5½ per cent sinking-fund gold bonds, series A, at 96 and interest, to yield about 5.80 per cent.

The American Public Service Company made an offering of first lien 5 per cent gold bonds, series C, priced at 93 and interest, yielding about 5.65 per cent, a piece of financing involving $2,500,000. These bonds are due Dec. 1, 1942.

The Central Public Service Company issued first lien collateral trust 6 per cent gold bonds, series A, to the amount of $500,000, the price being 99 and accrued interest.

The National Public Service Corporation issued additional 7 per cent cumulative preferred stock, series A, to the amount of $1,250,000.

Another German loan was floated during the past week in the form of 6½ per cent notes of the Berlin City Electric Company (Berliner Städtische Elektrizitätswerke Aktien-Gesellschaft), dated Feb. 1, 1926, and amounting to $3,000,000. The notes due Feb. 1, 1928, totaling $1,000,000, were priced at 99 and interest, to yield over 7 per cent, and the notes due Feb. 1, 1929, totaling $2,000,000, were priced at 98½ and interest, to yield over 7 per cent. The city of Berlin owns all the stock of the company.

Brooklyn Edison Issues Annual Report.—The annual report of the Brooklyn Edison Company for 1925, just issued, shows a very considerable increase in the company's business over the previous year. For the second year in succession Brooklyn Edison has connected more than 100,000 new meters to its system. The total of meters connected at the end of 1925 was 601,257 as compared with 498,791 at the end of 1924. There was an increase of 94,000,000 kw.-hr. in the sales of energy, bringing the total sales for 1925 to 594,576,980 kw.-hr. Gross revenues were $26,030,840 in 1924 and $29,887,300 for 1925, while the comparative figures for net income after the payment of operating expenses, taxes, interest on bonded debt, etc., were $7,059,011 in 1924 and $7,404,882 for 1925.

Company Reports

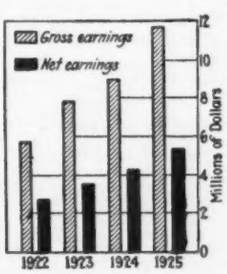
Name of Company	Gross Earnings for December 1925	1924
Alabama Power	$1,125,080	$816,889
Bangor Hydro-Electric	152,711	141,487
Baton Rouge Electric	75,820	65,085
Binghamton Lt., Ht. & Pwr.	160,930	142,275
Blackstone Valley Gas & Elec.	493,744	437,434
Cape Breton Electric	59,350	56,491
Central Illinois Light	374,289	364,280
Cities Service	1,758,800	1,393,782
Columbia Gas & Electric	3,522,837	2,500,387
Columbus Electric & Power	265,675	216,569
Commonwealth Power	4,329,452	2,736,701
Consumers Power	2,003,489	1,647,217
Eastern Texas Electric	400,581	202,032
Edison Elec. Illg. (Brockton)	167,739	152,628
Elec. Lt. & Pwr. of Abington & Rockland County	53,780	44,225
El Paso Electric	233,164	214,490
Florida Public Service	121,971	75,048
Galveston-Houston Electric	340,857	330,667
Houghton County Elec. Lt.	53,850	52,237
Illinois Power	262,608	250,537
Key West Electric	24,851	20,768
Lowell Electric Light	164,066	153,972
Metropolitan Edison	801,156	730,810
New Bedford Gas & Edison Lt.	366,758	344,722
New Jersey Power & Light	194,089	107,571
North Carolina Public Service	167,771	157,392
Northern Ohio Power	1,049,084	962,038
Northern Texas Electric	222,428	248,288
Ohio Edison	169,005	149,785
Philadelphia Co. & Affil. Corp.	6,072,375	5,827,271
Portland Electric Power	1,028,568	974,992
Public Service of N. J. & subs.	9,063,579	8,243,143
Puget Sound Power & Light	1,195,274	1,178,106
Republic Railway & Light	1,087,269	988,322
Savannah Electric & Power	185,899	168,262
Sayre Electric	27,313	24,756
Sierra Pacific Electric	96,243	101,109
Southern Indiana Gas & Elec.	261,369	252,219
Tampa Electric	352,324	236,817
Tennessee Electric Power	1,115,819	934,548
Washington Water Power	565,567	485,165
York Utilities	16,184	16,656

Southeastern Rounds Out Big System

Its Financial Union with the Georgia Railway & Power Swells Gross Revenues to $35,000,000—Enormous Savings Are Seen in Co-ordinated Service

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

WHAT originally was the Alabama Power Company, doing a comparatively modest business in certain Alabama communities a few years ago, has, through an unusual combination of factors, now been built up into one of the country's larger and most powerful utilities. Creation of the parent holding company, known as the Southeastern



EARNINGS OF ALABAMA POWER COMPANY SHOW CONSISTENT GROWTH

Power & Light Company, has helped to extend the system's territory to include the whole of Alabama, the northwestern region of Florida, the eastern half of Mississippi and, through the recent purchase of the Georgia Railway & Power Company, the richest sections of Georgia.

In 1924 the Southeastern's gross earnings aggregated only $9,800,000. They jumped to $16,700,000 in 1925 as a result of the annexation of new properties and the extraordinary growth of the territory. Addition of Georgia now raises the Southeastern's annual earnings to the thirty-five-million-dollar class, and, if conservative calculations are borne out, the gross will pass the fifty-million-dollar mark within five years.

Co-ordination of the Southeastern and Georgia properties will, it may be safely reckoned, effect an annual saving to the system in net earnings of $2,000,000 or $3,000,000 within a reasonably short period. Development of the upper waters of the Coosa River in Georgia, for example, will create reservoirs by which the minimum flow of that river may be trebled. Since the river runs to the sea through the State of Alabama and is the one that is used by Alabama Power Company plants, the Georgia development indirectly will increase the minimum capacity of cer-

tain Alabama plants three times without expense.

Counting what has already been developed and what is in the process of development, Southeastern itself has 550,000 hp., which, when allowance is made for the 240,000 hp. added by Georgia, lifts the total to 790,000 hp. In addition, however, the combined system has between 1,000,000 hp. and 1,125,000,000 hp. undeveloped and which can readily be developed during the years immediately ahead as the demands for power multiply. If Muscle Shoals eventually goes to the system, that power would be in addition to what is mentioned above.

Southeastern's only funded obligations now outstanding, after giving effect to the financing for the Georgia purchase, will be an issue of $25,838,400 of 6 per cent debentures that do not mature for a century, in 2025. Following these long-term debentures come 19,375 shares of seven-dollar cumulative preferred stock. Next comes the issue of participating preferred stock that was created to help finance the Georgia purchase without letting go of too much common stock.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Feb. 6	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com.			
—no par	k 82¼	71¼	84¼
Adirondack Pwr. & Lt.—7% pf.	k103	....	....
Adirondack Pwr. & Lt.—8% pf.	109	n103	n115
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k105	....	....
Allis-Chalmers Mfg. pf.	109¼	109	110
Allis-Chalmers Mfg., com.	k 91¼	90	94¼
Aluminum Co. of Amer., com.	k 63¼	55	65¼
Aluminum Co. of Amer. new, pf.	k 98¼	....	....
Amer. & Foreign Pwr., pf. 25% pd.	127	127¼	131
Amer. & Foreign Pwr., 7% pf.—no par	k 93¼	91¼	94
Amer. & Foreign Pwr., com.—no par	k 38¼	37	42¼
Amer. Bosch Magneto, com—no par	k 29¼	28¼	34¼
Amer. Brown Boveri, Elec.	k 45	43¼	48¼
Amer. Elec. pwr., pf.	c105	101¼	105
Amer. Gas & Elec., 6% pf.—no par.	k 93	....	....
Amer. Gas & Elec., com.—no par...	k 95	80	99¼
Amer. Lt. & Trac., 6% pf.	k114	114	116¼
Amer. Lt. & Trac., com.	k252	232	263
Amer. Pwr. & Lt., 6% pf.	k 94	93¼	96
Amer. Pwr. & Lt., com.—no par....	k 74¼	68¼	79¼
Amer. Pub. Serv., 7% pf....	k 96	....	....
Amer. Pub. Serv., com.	47	n 45	n 90
Amer. Pub. Utilities, 4% pf.	85	....	....
Amer. Pub. Utilities, 6% pf.	k 83	....	....
Amer. Pub. Utilities, 7% pf.	k 87	....	....
Amer. Pub. Utilities, com.	78	n 70	n103
Amer. States Sec., A	k 8	....	....
Amer. States Sec. B	k 5	....	....
Amer. Superpwr., pf.—25	k 25¼	25	25¼
Amer. Superpower, pf.	92	n 92	n 95½
Amer. Superpwr., Class A—no par..	k 34¼	33¼	37
Amer. Superpwr., Class B—no par..	k 35¼	34¼	34¼
Amer. Wtr. Wks. & Elec., 7% pf.	k104	102¼	105¼
Amer. Wtr. Wks. & Elec., com.—20.	k 70	68	74
Anaconda Copper	k 50	46¼	50¼
Appalachian Pwr., 7% pf.	101	n 92	n100
Appalachian Pwr., 1st pf., 7%	102	n 95	n101
Appalachian Pwr., com.	80	n 70	n 83
Arizona Pwr., 7% pf.	k 80	....	....
Arizona Pwr., com.	35	n 15	n 34½
Arkansas Cent. Pwr., pf., $7—no par	101¼	n 97	n102
Arkansas Lt. & Pwr., 7% pf.	k 99	....	....
Arkansas Lt. & Pwr., com.	100	n 65	n101
Asheville Pwr. & Lt., 7% pf.	i102¼	100¼	103¼
Assoc. G.&E., 7% pf.—1% extra—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 80	....	....
Assoc. Gas & Elec., Class A—no par	k 32	31¼	35½
BABCOCK & WILCOX, com.	k143	....	....
Binghamton Lt., Ht. & Pwr., pf.	102	n 90	n101
Birmingham Elec. pf.—$7—no par...	102¼	n 98	n103
Blackstone Valley Gas & Elec., pf.	102	n 95	n100
Blackstone Valley G.&E., com.—50.	k104	97	118¼
Blaw-Knox, com.	i 54¼	54	56
Brazilian Trac., Lt. & Pwr., com.	f 92¼	....	....
Broad River Pwr., pf.	94	n 90	n 97
Brooklyn Edison, com.	k144¼	133¼	146¼
Buffalo Gen. Elec., com.—no par.	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	l 24	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	l 36¼	....	....
CALIFORNIA ELEC. GENERATING, pf.	92	n 89	n 93
California Ry. & Pwr., pf.	90	n 88	n100
Carolina Pwr. & Lt., pf.—$7—no par	105½	n100	n107
Carolina Pwr. & Lt., com.	420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par .	a 92½	89¼	94
Cent. & S. W. Ut., pr. in. pf.—no par	a 99	99¼	99¼
Central Ariz. Lt. & Pwr., pf.	102	n100	n106
Central Ark. Ry. & Lt., 7% pf.	k100	....	....
Central Ill. Pub. Serv., 6% pf.	89	n 84	n 93
Central Ind. Pwr., 7% pf.	90	n 88	n 95
Central Pwr. & Lt., pf.	k 93½	....	....
Central States Elec., 7% pf.	k 93½	....	....
Central States Elec., com.	200	n 70	n250
Century Elec., com.	m103	n103	n110
Chicago Fuse Mfg., com., no par...	a 34	32	34
Cincinnati Gas & Elec., com.	g 92	89	92
Cities Service, 6% pf.	k 83½	....	....
Cities Service, pf.B—10.	k 7¼	....	....
Cities Service, pf. BB—100.	k 77	....	....
Cities Service, com.—20.	k 38	....	....
Cities Service, Bks. Shrs.—10.	k 17¼	....	....
Clarion River Pwr., pf.	93	n 91	n 96
Cleveland Elec. Illg., 6% pf.	102	n101	n105
Cleveland Elec., Illg., com.	k240	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	113	113	115
Columbia Gas & E., com.—no par..	k 85½	83¼	90
Columbia Ry., Gas & Elec., 6% pf..	k114½	n 90	113
Columbus Elec. & Pwr., 2d pf.	k100	....	....
Columbus Elec. & Pwr., com.	k157	....	....
Columbus Ry., Pwr. & Lt., pf. A..	98	n 86	n 99
Columbus Ry., Pwr. & Lt., pf. B..	92	n 80	n 85
Col. Ry., Pwr. & Lt., com.—no par.	82	n 70	n 85
Commonwealth Edison, com.	a142½	139¼	144
Commonwealth Pwr., 6% pf.	k 86½	....	....
Commonwealth Pwr., com—no par..	k 41¼	39	42¼
Conn. Lt. & Pwr., 8% pf.	118	n115	n118
Conn. Lt. & Pwr., 7% pf.	110	n105	n110
Cons. Gas of N. Y., pf.—50.	k 59½	....	....
Cons. Gas of N.Y., com.—no par.	k 99	94¼	100¾
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e102¼	102	103
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	e109¼	108¼	110
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e111¼	110¼	111¼
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127¼	124	127¼
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	c 52	45	52¼
Cons. Utilities of Dela., 7% pf....	m 85	n 80	n 84
Consumers Pwr., 6% pf.	97¼	n 90	n 97
Consumers Pwr., 6.6% pf.	102	n 97	n102
Continental Gas & Elec., 7% ptc. pf	k101	....	....
Continental Gas & Elec., 7% pr. pf.	98	n 89	n 97
Continental G.&E., com.—no par....	143	n 77	n152
Crocker Wheeler, com.	14	n 9	n 28
Crocker Wheeler, pf.	45	n 47	n 80
DALLAS PWR. & LT., 7% pf.	102	n100	n102½
Dayton Pwr. & Lt., 6% pf.	97	n 88	n100
Dayton Pwr. & Lt., com.	420	n180	n460
Detroit Edison, com.	k139	133	141¼
Dubilier Condenser & Radio, com. no par.	k 8½	7¼	11
Dubuque Elec., 7% pf.	94	n 80	n 90
Duquesne Lt., 7% pf.	113	112¼	113½
EAST. N. Y. UTIL. pf.	70	n 71	n 80
Eastern New York Util., com.	55	n 52	n 65
Eastern States Power.	k 32	....	....
Eastern States Pwr., pf. with warrants	m120	....	....
Eastern States Pwr., pf. without warrants	k 92	....	....
Eastern Tex. Elec., 7% pf.	k101	....	....
East. Tex. Elec., com.—no par.	k100	....	....
Edison Elec. Illum. of Boston, com..	d210½	207	212
E. Paso Elec., com.—no par	k 54	....	....
E. Paso Elec. pf.	k102	....	....
Elec. Bond & Share, 6% pf.	l105½	103¼	107¼
E. Bd. & Share Sec., com.—no par..	l80	79	86
Elec. Investors, 6% pf.—no par....	92	n 95	n 96
Elec. Investors, com.—no par.	k 68½	66	74½
Elec. Investors, 10% pd. receipts...	50	n 15	n 62
Elec. Pwr. & Lt., ctfs, pf.	k 95½	91½	95½
Elec. Pwr. & Lt., ctfs., 40% pd....	k110	105½	110½
Elec. Pwr. & Lt., ctfs. full pd.	108	107	110½
Elec. Pwr. & Lt., ctfs., com.—no par	k 32½	30	33½
Elec. Ry. Securities, com.—no par..	k 8½	....	....
Elec. Refrig.	k 81¼	78	90½
Elec. Storage Battery, com.—no par.	k 78½	73	78½
Elmira Wtr., Lt. & R. R., 7% pf....	99	n 93	n 98
Emerson Elec. pf.	b103½	100	104½
Empire Dist. Elec., 6% pf.	80	n 78	n 85
Empire Pwr., A.	k 32½	....	....
Eng. Pub. Serv., pf.—no par.	k100½	99	102
Engr. Pub. Serv., com.—no par..	k 27	24	29½
Eureka Vac. Cleaner, com.—no par...	k 52½	47½	53½
FAIRBANKS MORSE, com—no par	k 56½	....	....
Fairbanks Morse, pf.	114¼	108½	111½
Federal Lt. & Trac., com.	k 38½	35¼	39¼
Federal Light & Traction, pf.	87	88	89
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	i106	105	107
GALVESTON-HOUSTON ELEC., 6% pf.	k 61	....	....
Galveston-Hstn El., com.	k 21	....	....
Gen. Elec., com.	k348½	323	350½
Gen. Elec., special—10.	k 11¼	11	11¼
Gen. Gas & Elec., A.	k 53	51¼	59
Gen. Gas & Elec., pf. A.	m 98½	98¼	99½
Gen. G.&E., (Del.) com. A no par..	51½	n 42	n 64½
Gen. G.&E., (Del.) com. B no par..	40	n 40	n 62
Gen. G.&E., (Del.) A pf. $8 no par.	108½	n 90	n111
Gen. G.&E., (Del.) A pf. $7 no par..	97½	n 97½	n100
Gen. G.&E., (Del.) B pf.	95½	n 88	n 97½
Ga. Lt., Pwr. & Rys., 6% pf.	80	n 74	n 85
Ga. Lt., Pwr. & Rys., com.	59	n 25	n 74
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m126	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	n101	n114
Ga. Ry. & Pwr., 7% pf.	101	n100	n102½
Ga. Ry. & Pwr., 4% pf.	138	n 62	n154
Ga. Ry. & Pwr., com.	k138	....	....
Gt. Western Pwr., 7% pf.	k101	....	....
HAVANA ELEC. UTIL., com.	44	43½	44½
Havana Elec. Util., pf.	69	68½	69
Hurley Machine, com.—no par.	m 50½	44½	51
IDAHO PWR., 7% pf.	102½	n 97½	n102
Ill. No. Utilities, 6% pf.	k 88	....	....
Ill. Pwr. & Lt., 7% pf.	k 97	....	....
Ingersoll Rand.	95	90	104
Int. Combt. Engr., com.—no par..	k 59½	53¼	64½
Int. Utilities, class A—no par.	k 37½	....	....
Int. Utilities, class B—no par.	k 7¼	7¼	9½
Interstate Pwr., pf., $7 no par.	92	n 90	n 98
Interstate Pub. Serv., 7% pf.	96½	n 90	n100
Iowa Ry. & Lt., 7% pf.	97	n 92	n100
JERSEY CENTRAL PWR. & LT. 7% pf.	95½	n 90	n 96
Jersey Central Pwr. & Lt., com.—no par.	45	n 15	n 50
Johns-Manville, com.—no par.	k142	....	....
KANSAS CITY PWR. & LT., pf.	k108½	107¼	109
Kansas Gas & Elec., 7% pf.	l100½	99½	102
Kelvinator Corp., com.—no par.	k 82½	....	....
Kentucky Hydro-Elec., pf.	a 94	92	95
Kentucky Sec., 6% pf.	75	n 67	n 78
Kentucky Sec., com.	k 90	....	....
Kentucky Utilities, 6% pf.	90	n 82	n 95
Keystone Pwr. & Lt. 7% pf.	96	n 90	n 95
Kings County Ltg., 7% pf.	103	n 98	n101
Kings County, Ltg., 8% pf.	104	n103	n106
LACLEDE GAS LT., com.	160	160½	168
Lehigh Pwr. Sec., com.—no par....	k 20½	20	22
Long Island Ltg., 7% pf.	105	n100	n105
Long Island Ltg., com.—no par....	145	n 60	n142
Los Angeles Gas & Elec., 6% pf....	95½	n 90	n 98
Louisville Gas & Elec., Class. A....	k 25	22½	25½
MANHATTAN ELEC. SUPPLY.	k 69½	56	70½
Manila Elec., com.—no par.	31½	31½	32½
Maytag Mfg., com.	k 22	21½	22½
Memphis Pwr. & Lt., pf., $7, no par	103½	n 98½	n102
Metro. Edison, pf.—$6—no par.	92½	n 92	n 96
Metropolitan Edison, pf., $7, no par.	102½	n100	n110
Metropolitan Edison, com., no par..	45	n 45	n 50
Middle West Utilities, 7% pf.	a106½	97½	109
Middle West Utilities, 7% pr. lien pf.	a116½	106½	117
Middle West Utilities, com.—no par.	a132	115½	134½
Midland Utilities, pr. ln. pf.	a100	99	100
Midland Utilities pf. A.	m 96	96	96½
Milwaukee Elec. Ry. & Lt., 7% pf.	99	....	....
Milwaukee Elec. Ry. & Lt., 6% pf..	87	....	....
Minn. Pwr. & Lt., 7% pf.	l102½	100½	103
Miss. Pwr. & Lt., pf.	k102	....	....
Miss. River Pwr., 6% pf.	95	n 87½	n 94
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	103	n101	n105
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	k 94	....	....
Mohawk Hudson Pwr., com.—no par	k 23	....	....
Montana Pwr., pf.	m118	112¼	118
Montana Pwr., com.	k 80½	77¼	83¼
Montreal Pwr., com.	f 216	....	....
Mountain States Pwr., pf.	k 95	....	....
Mountain States Pwr., com.	k 24	....	....
NASSAU & SUFFOLK, LTG., pf.	93	n 88	n 95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	a127	127	127½
National Elec. Pwr., pf.	m 95½	93	95½
National Electric Pwr-A.	a 25½	24½	25
Nat.-Lt., Ht. & Pwr., com.—no par.	24	n 11	n 30
National Lt., Ht. & Pwr., 5% pf....	71	n 40	n 72
National Pwr. & Lt., pf., $7—no par.	k101½	100½	102½
National Pwr. & Lt., com.—no par..	k 32½	31¼	38½
National Pub. Serv., 7% pf.	91	n 90	n 96
National Pub. Serv., pte. pf.	95	n 93	n 97½
National Pub. Serv., A com.—no par	k 22½	22	24
National Pub. Serv., B com.—no par	16½	13½	17½
Nebraska Pwr., 7% pf.	l 104½	103	105½
Nevada-Calif. Elec., com.	35½	30½	44½
New Brunswick Pwr., pf.	35	n 30	n 40
New England Pub. Serv., pr. ln. pf..	98	n 97½	n 99
New England Pub. Serv., pf.	95	n 95½	n 97
N. J. Pwr. & Lt., 7% pf.	104	n 92	n102
New Orleans Pub. Serv., 7% pf....	101½	n 94	n102
New Orleans Pub. Serv., com.—no par.	m 30	n 31	n 38½
N. Y. Central Elec., 7% pf.	99	n 96	n101
Newport News & Hampton Ry., Gas & Elec., com.	108	n 85	n100
Newport News & Hampton Ry., Gas & Elec., pf.	108	n 90	n105
Niagara Falls Pwr., 7% pf.—25....	28½	28	28½
Niagara, Lock. & Ont. Pwr., 7% pf..	m101	n101½	n110
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60½	n 60	n 73
Nizer Corp., A.—no par.	m 84½	n 37	n 84½
Nizer Corp., B.—no par.	k 81	76	89½
No. Amer., 6% pf.—50.	k 50	49	50½
No. Amer., com.—10.	k 64½	63½	67
No. Amer. Edison pf.—no par.	94	92½	95½
No. Amer., Lt. & Pwr., pf.	88	n 87	n 91
N.C. Pub. Serv., pf.—$7—no par..	k 91	....	....
Northeastern Pwr., com.	k 33½	32½	36½
No. Indiana Gas & Elec., pf. A....	98	n 96	n 98½
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 23½	15½	26½
No. Ohio Trac. & Lt., 6% pf.	79½	n 64	n 75
No. Ohio Trac. & Lt., 7% pf.	89	n 85½	n 88
No. Ont. Lt. & Pwr., pf.	k 75	....	....
No. Ont. Lt. & Pwr., com.	63½	n 41	n 52
No. States Pwr., 7% pf.	k101	100	101½
No. States Pwr. com.	k127	125½	136½
No. Texas Elec., 6% pf.	k 61	....	....
No. Texas Elec., com.	k 42	....	....
OHIO BRASS, com. B—no par.	74	n 72	n 79
Ohio Brass, pf.	99	n 92	n102
Ohio Gas & Elec., 7% pf.	90	n 87	n100
Ohio Pwr., 6% pf.	93	n 85	n 95
Ohio Pub. Serv., 6% pf.	89	n 87	n 93
Ohio Pub. Serv., 7% pf.	98½	n 97	n100
Ohio River Edison, pf.	99	n 93½	n100½
Oklahoma Gas & Elec., pf.	k 95	....	....
PACIFIC GAS & ELEC., 6% pf.	k 97½	....	....
Pacific Gas & Elec. com.	130½	126½	132½
Pacific Pwr. & Lt., 7% pf.	l 99½	98	101

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Monday, Feb. 8. *l*Bid, low, high, Tuesday, Feb. 9. *m*Latest quotations available, *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Feb. 6	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	*n* 90	*n*100
Penn Central Lt. & Pwr., pf.—no par	*c* 72¼	72¼	73½
Penn-Ohio Elec., 7% pf.	93	*n* 83½	*n* 96
Penn-Ohio Pwr. & Lt., 7% pf.	94½	*n* 91	*n*100
Penn-Ohio Pwr. & Lt., 8% pf.	101	*n*101	*n*110
Penn Pwr. & Lt.—$7—no par	*l*105½	103	106
Penn Pub. Serv., 7% pf.	98	*n* 90	*n*100
Penn Pub. Serv., 6% pf.	85	*n* 80	*n* 90
Penn Wtr. & Pwr., com.	*e*163	160½	171
Phila. Co., pf.—50	*m* 48	47¾	48½
Phila. Co., com.—50	*k* 68½	63	70½
Phila. Elec., com.—25	*c* 62¼	54½	67½
Pittsburgh Utilities, pf.—10	*k* 16	15½	16½
Portland Elec. Pwr., 7% pf.	97	*n* 95	*n* 99
Portland Elec. Pwr., 6% pf.	72½	*n* 70	*n* 80
Portland Elec. Pwr., com.	*k* 49	....	....
Portland Ry., Lt. & Pwr.,pf.	*m* 72½	....	....
Portland Ry. Lt. & Pwr., com.	*k* 49	....	....
Potomac Elec. Pwr., pf.	*j*107½	....	....
Pwr. Corp. of N. Y., 7% pf.	*m*110	*n* 96	*n*112
Pwr. Corp. of N.Y., com—no par	*k* 83	79	90½
Pwr. Sec., pf.—no par	*k* 21	....	....
Pwr. Sec., com.—no par	*k* 9	....	....
Pub. Serv. of N. J., 7% pf.	108	103½	108½
Pub. Serv. of N. J., 8% pf.	*k*118½	115½	119
Pub. Serv. of N. J., com.—no par	*k* 87	79½	92½
Pub. Serv. of No. Ill., 6% pf.	*a*102	100½	102½
Public Serv. of No. Ill., 7% pf.	*a*114	112	115
Pub. Serv. of No. Ill., com.—no par	*a*135	130	137
Pub. Serv. of No. Ill., com.	*a*135	130	135
Pub. Serv. of Okla., 7% pf.	92	*n* 87	*n* 95
Pub. Serv. Elec. & Gas, 6% pf.	98½	97	99½
Puget Sound Pwr. & Lt., 7% pf.	*k*107	....	....
Puget Sound Pwr. & Lt., 6% pf.	*k* 84	....	....
Puget Sound Pwr. & Lt., com.	*k* 60	....	....
RADIO CORP. OF AM., pf.—50	*k* 47½	45½	47½
Radio Corp. of Amer., com.—no par	*k* 43¾	41	46½
Republic Ry. & Lt., pf.	*k*102	....	....
Republic Ry. & Lt., com.	93	*n* 49	*n* 67
Rochester Gas & Elec., 5% pf.	95	*n* 80	*n* 98
Rochester Gas & Elec., 6% pf.	100	*n* 96	*n*100
Rochester Gas & Elec., 7% pf.	104	*n*103	*n*106½
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	*n* 60	*n* 65
Servel Corp., Class A	*k* 28¾	26½	30½
Servel Corp., Class B—no par	*k* 60	....	....
Sierra Pacific Elec., com.	*k* 25½	25	28¾
Sioux City Gas & Elec., 7% pf.	96	*n* 97½	*n* 99½
S. E. Pwr. & Lt., 7% pf.—no par	99	*n* 90	*n*100
S. E. Pwr. & Lt., com.—no par	*k* 40½	40½	46½
So. Calif. Edison, 8% pf.	135	*n*115	*n*128
So. Calif. Edison, 7% pf.	*k*111	....	....
So. Calif. Edison, 6% pf.	*k* 98	....	....
So. Calif. Edison, com.	*k*135½	128	141½
Southern Cities Utilities, 7% pf.	88	*n* 77	*n*100
Southern Cities Utilities, com.	*k* 48	....	....
Southern Pwr. & Lt. of Md., pf.	*m*107	....	....
Southern Pwr. & Lt. of Md., com.	*m* 32	....	....
Southwestern Lt. & Pwr., A	*k* 55	....	....
Southwestern Lt. & Pwr., B	*k* 42	....	....
Southwestern Lt. & Pwr., 6% pf.	*k* 90	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*102	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	96	*n* 92	*n* 93
Standard Gas & Elec., 8% pf.	*k* 56½	54½	*k* 56½
Standard Gas & Elec., 7% pf.	*k*100½	....	....
Standard Gas & Elec., com.—no par	*k* 69	55½	69
Standard Pwr. & Lt., 7% pf.	*k* 90	....	....
Superheater, com.—no par	*k*140	....	....
Syracuse Lighting, 7% pf.	105	*n*103	*n*107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	265	*n*115	*n*265
TAMPA ELEC., com.	*k*302½	292	312
Tenn. Elec. Pwr., 6% pf.	*k* 87	....	....
Tenn. Elec. Pwr., 7% pf.	*k*101	....	....
Tenn. Elec. Pwr., pf.—$6—no par	*m* 80	....	....
Tenn. Elec. Pwr., com.—no par	*m* 65	....	....
Terre Haute, Ind. & East Trac., pf.	27	*n* 22	*n* 35
Terre Haute, Ind. & East Trac., com	3	2½	....
Tex. Pwr. & Lt., 7% pf.	*l*103½	102	104½
Tide Water Pwr., 8% pf.	*k*100	....	....
Timken Roller Bearing, com—no par	*k* 55½	52½	56½
Toledo Edison, 8% pf.	113	*n*109	*n*114
Toledo Edison, 7% pf.	*k*101½	....	....
Toledo Edison, com.	*m* 25	*n* 21	*n* 25
Tri-City Ry. & Lt., 6% pf.	88½	*n* 82	*n* 85
UNITED GAS & ELEC., 6% pf.	96	*n* 80	*n* 94
United Gas & Elec., com.—no par	63	*n* 26	*n* 57½
United Gas & Elec. (N.J.), 5% pf.	70	*n* 55	*n* 65
United Gas Impr.—50	*c*135½	119	144½
United Lt. & Pwr., pf.—$4—no par.	49½	*n* 41	*n* 51
United L. & P. pf.—$6.50—no par	88½	*n* 83	*n* 99
United Lt. & Pwr., com., A—no par	138	*n* 42	*n*166½
United Lt. & Pwr., com., B—no par	150	*n* 49	*n*100
Utah Pwr. & Lt., 7% pf.	*l*102½	99	103
Utica Gas & Elec., 7% pf.	105	*n*100	*n*104
Utica Gas & Elec., com.	200	*n*100	*n*200
Utilities Pwr., & Lt., 7% pf.	92	*n* 90	*n* 97
Utilities Pwr. & Lt., com. B—no par.	16½	*n* 12	*n* 22
VERMONT HYDRO - ELEC., 7% pf.	95	*n* 87	*n* 96
Virginia Pwr., 7% pf.	102	*n* 94	*n*107
Virginia Pwr., com.	65	*n* 65	*n* 92
Virginia Ry. & Pwr., com.	*m*149	*n* 64½	*n*150
WAGNER ELEC., pf.	*b* 83	82	85
Wagner Elec., com.—no par	*b* 31	30	34½
Washington Ry. & Elec., com.	*j*206	....	....
Washington Ry. & Elec., pf.	*j* 91	....	....
Washington Wtr. Pwr., com.	130	*n*110	*n*140
West Mo. Pwr., 7% pf.	*k* 91	....	....
West Penn., 7% pf. tem. ctfs.	97	96½	97½
West Penn, com.	125	123	130
West Penn Elec., pf.	*k* 98½	96½	98½
West Penn Elec., Class A	*k* 92½	88½	92½
West Penn Pwr., pf.	108	109	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	*n* 94½	*n* 96½
West Va. Utilities, 7% pf.—50	43½	*n* 38	*n* 47
Western Pwr., 7% pf.	*k* 98½	96	99
Western Pwr., com.—no par	*m* 80	*n* 34	*n*102
Western States Gas & Elec., 7% pf.	89	*n* 82	*n* 92
Western States Gas & Elec., com.	*k* 19½	....	....
Westinghouse El. & Mfg., com—50	*k* 77¼	72	77½
Weston Elec. Instrument, Class. A	29½	27½	29½
Weston Elec. Instrument, com.	*k* 17½	15½	18½
Wheeling Elec., pf.	91	*n* 88	*n* 93½
Wis.-Minn. Lt. & Pwr., 7% pf.	*m* 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	*n* 85	*n* 90
Worthington Pump, pf. A	77	77	80
Worthington Pump, pf. B	62	60	63
Worthington Pump, com.	*k* 42	37½	44½
YADKIN RIVER PWR., 7% pf.	*l*103	102	105
Yale & Towne, com.—25	*k* 63	62½	64½
BONDS			
ABITIBI PWR., & PAPER	6s	1940 *m*100	....
Adir. Elec. Pwr.	5s	1962 *k*100½	....
Adir. Pwr. & Lt.	6s	1950 *k*105½	....
Adir. Pwr. & Lt.	5s	1930 97	*n* 94 *n*98
Ala. Pwr.	5s	1946 99½	*n* 96 *n*100
Ala. Pwr.	5s	1951 98	*n* 92½ *n* 97½
Ala. Pwr.	6s	1951 105	*n*101 *n*105½
Ala. Trac., Lt. & Pwr.	5s	1962 122	*n* 86 *n*115½
Aluminum Co. of Amer.	7s	1933 *k*106½	106½ 107
Amer. Bosch Magneto	8s	1936 *m*103	....
Amer. Gas & Elec.	5s	2007 92	*n* 90 *n* 93½
Amer. Gas & Elec.	6s	2014 *k* 99½	98 99½
Amer. Pwr. & Lt.	6s	2016 *k* 97½	96 98
Amer. Pub. Serv.	6s	1942 99½	*n* 94 *n* 99½
Amer. Wtr. Wks. & Elec.	5s	1934 97½	95½ 97½
Amer. Wtr. Wks. & Elec.	6s	1975 *k* 94½	94 93½
Anaconda Copper	6s	1929 103½	102½ 103½
Anaconda Copper	6s	1953 *k*102½	101½ 102½
Anaconda Copper	7s	1938 *k*106½	....
Appalachian Pwr.	5s	1941 *k* 98½	....
Appalachian Pwr.	6s	2024 92½	*n* 87 *n* 94½
Appalachian Pwr.	7s	1936 105½	*n*105 *n*106½
Arizona Pwr.	6s	1933 100	*n* 97½ *n*101
Arizona Pwr.	6s	1947 96	*n* 90 *n* 96½
Ark. Central Pwr.	6s	1948 102	*n* 98½ *n*102½
Ark. Lt. & Pwr.	6s	1945 *k*103	....
Ark. Lt. & Pwr.	6s	1954 100	*n* 92½ *n* 99½
Assoc. Gas & Elec.	6s	1965 *k* 94	94 95½
Assoc. Gas & Elec.	6½s	1954 *k*100	....
BINGHAMTON LT., HT. & PWR.	5s	1946 *k* 99	....
Birmingham Elec.	6s	1954 103	*n* 99 *n*103
Birmingham Ry., L. & P.	4½s	1954 89	*n* 85 *n* 89½
Broad River Pwr.	6½s	1934 100½	*n* 99 *n*102
Brooklyn Edison	5s	1949 *k*103½	....
Brooklyn Edison	6s	1930 105	104½ 105½
Buffalo Gen. Elec. 1st	5s	1939 102	*n*100½ *n*102½
Buffalo G. E., 1st & Ref.	5s	1939 101½	*n*100 *n*101½
Buffalo G. E.	5s	1956 *k*100½	99½ 100½
Burlington Ry. & Lt.	5s	1932 96½	*n* 90 *n* 96
Butte Elec. & Pwr.	5s	1951 *k*100½	....
CALIF. ELEC. GEN.	5s	1948 *k* 99½	....
Calif. Gas & Elec.	5s	1937 *k*100½	....
Calumet Gas & Elec.	5½s	1960 96½	*n* 97 *n* 98½
Canadian Lt. & Pwr.	5s	1949 54	*n* 36 *n* 62
Canton Elec.	5s	1937 100	*n* 99 *n*100½
Carolina Pwr. & Lt.	5s	1938 100½	*n* 98½ *n*100½
Carolina Pwr. & Lt.	6s	1953 *k*104½	*n*103½ *n*105
Cedar Rap. Mfg. & Pwr.	5s	1953 99½	*n* 98½ *n*100½
Central Ark. Ry. & Lt.	5s	1928 99½	*n* 98½ *n*100
Central Ga. Pwr.	5s	1938 95½	*n* 93 *n* 97
Central Ill. Lt.	5s	1943 *k* 98½	....
Central Ill. Pub. Serv.	5s	1952 90½	*n* 84½ *n* 92½
Central Ill. Pub. Serv.	5½s	1950 95½	*n* 96½ *n* 98
Central Ill. Pub. Serv.	6s	1944 99½	*n* 96½ *n*101½
Central Ind. Pwr.	6s	1947 98	*n* 95½ *n* 99½
Central Ia. Pwr. & Lt.	6s	1944 100	*n* 97 *n*101
Central Maine Power	5s	1939 98½	*n* 98½ *n*100
Central N. Y. Gas & El.	5s	1941 *k* 98	....
Central Pwr. & Lt.	6s	1946 100½	*n* 97½ *n*101½
Central Pwr. & Lt.	6½s	1952 *k*101½	....
Central States Elec.	5s	1926 *m* 99	....
Chattanooga Ry. & Lt.	5s	1956 83½	*n* 81 *n* 85
Cincinnati Gas & Elec.	5s	1956 103	102½ 103
Cincinnati Gas & Elec.	5½s	1961 104½	102½ 104½
Cities Service	6s	1966 *k* 93½	92½ 93½
Cities Service	7sB	1966 *k*178	178 180
Cities Service	7sC	1966 *k*125½	125½ 127
Cities Service	7sD	1966 *k*101½	101½ 102
Cities Service	7sE	1966 *k*108	....
Cities Service Pwr. & Lt.	6s	1944 *k* 94½	93½ 94½
City L. & T., Sedalia, Mo	5s	1952 84	*n* 74 *n* 85
Cleveland Elec. Illum.	5s	1939 102½	*n*100 *n*103
Cleveland Elec. Illum.	5s	1954 *k*102½	....
Cleveland Elec. Illum.	7s	1941 110	*n*109 *n*111½
Colorado Pwr.	5s	1953 96	*n* 93 *n* 96½
Columbia Gas & Elec.	5s	1927 99½	*n* 99½ *n*101
Columbia Ry., Gas & El.	5s	1936 92½	*n* 92½ *n* 95
Columbus, Dela. & Marion Elec.	5s	1937 84	*n* 83 *n* 88
Columbus, Dela. & Marion Elec.	6s	1937 94	*n* 91 *n* 98
Columbus Elec. & Pwr.	6s	1947 *k*102	....
Columbus Ry., Pwr. & Lt.	5s	1940 *k* 95	....
Columbus Ry., Pwr. & Lt.	6s	1941 *k*102	....
Commonwealth Edison	5s	1943 *k*102½	....
Commonwealth Edison	5s	1953 100	*n* 98½ *n*101
Commonwealth Edison	5s	1954 *k*100	....
Commonwealth Pwr.	5s	1939 *k* 91½	....
Commonwealth Pwr.	6s	1972 *k* 95	....
Commonwealth Pwr.	6s	1947 103½	102½ 104
Community Pwr. & Lt.	6s	1950 98½	*n* 94½ *n* 99
Conn. Ry. & Ltg.	4½s	1951 91½	91½ 92
Consol. Cities Lt., Pwr. & Trac.	5s	1962 80½	*n* 75½ *n* 82½
Consol. Elec.	5s	1955 97½	*n* 94 *n* 98½
Consol. Gas of N. Y.	5½s	1945 105	104½ 105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935 *e* 98	97½ 98
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 *e*106½	105½ 107
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965 101	100 101
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952 105	105 105½
Consumers Elec. L. & P.	5s	1936 *k* 96½	....
Consumers Pwr.	5s	1936 *k*100½	....
Consumers Pwr.	5s	1952 99½	97½ 100½
Consumers Pwr.	5½s	1954 *k*103½	....
Continental Gas & Elec.	5s	1927 *k*100	....
Continental Gas & Elec.	6s	1947 *k*100½	....
Continental Gas & Elec.	6½s	1964 *k* 99	....
Continental Gas & Elec.	7s	1954 *k*112	....
Cumberland County P.&L.	5s	1942 95	*n* 92 *n* 96½
DALLAS PWR. & LT.	6s	1949 104	*n*103 *n*105½
Dayton Ltg.	5s	1937 100	*n* 98½ *n*100½
Dayton Pwr. & Lt.	5s	1941 *k* 99½	....
Defiance Gas & Elec.	5s	1942 97	*n* 88½ *n* 97½
Denver Gas & Elec.	5s	1949 98½	*n* 97½ *n*100
Denver Gas & Elec. Lt.	5s	1951 94½	94 95½
Des Moines Elec.	5s	1938 99	*n* 98 *n*100½
Detroit Edison	5s	1933 101½	101 101½
Detroit Edison	5s	1940 101½	100½ 102½
Detroit Edison	5s	1949 101	100 102½
Detroit Edison	5s	1955 101½	100½ 101½
Detroit Edison	6s	1932 *m*135	135 135
Detroit Edison	6s	1940 *m*107½	....
Detroit Edison	7s	1928 *m*134	....
Detroit Edison	7s	1929 *m*138½	....
Detroit Edison	7s	1930 138½	134½ 138½
Dominion Pwr. & Trans	5s	1932 95½	*n* 95½ *n* 98½
Driver-Harris	8s	1931 95	*n* 88 *n* 97
Dubuque Elec.	6s	1942 102½	*n* 97½ *n*102
Duke-Price Pwr.	6s	1949 102½	*n* 98½ *n*103
Duquesne Lt.	6s	1949 106½	105½ 107
Duquesne Lt.	5½s	1949 105½	105 106½
Durham Pub. Serv.	7s	1949 100	*n* 97½ *n*101½
EAST PENN. ELEC.	6s	1953 104½	*n*100½ *n*105½
East Oregon Lt. & Pwr.	6s	1929 100	*n* 97½ *n*100½
East. Tex. Elec.	5s	1942 *k* 96	....
Economy Lt. & Pwr.	5s	1956 99	*n* 96 *n* 99½
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	*n* 98 *n*100½
Edison Elec. Illum. of Bklyn.	4s	1939 93	93 99½
Edison El. Illum. (N.Y.)	5s	1995 104	103 103½
El Paso Elec.	5s	1932 *k*102	....
El Paso Elec.	5s	1950 95	*n* 95 *n*96
El. Pwr. Corp. (Germany)	6½s	1950 87	85½ 87
Elec. Refrigeration	6s	1936 *k*105	104½ 107
Elmira Wtr., Lt. & R.R.	5s	1956 96	*n* 92½ *n* 97
Empire Dist. Elec.	5s	1949 91½	*n* 86½ *n* 93
Erie Ltg.	5s	1967 99	*n* 95½ *n* 99½
Evansville G. & El. Lt.	5s	1932 99	*n* 96 *n*100
FEDERAL LT. & TRAC.	5s	1942 94½	93½ 95
Federal Lt. & Trac.	6s	1942 102	101½ 103½
Federal Lt. & Trac.	6s	1954 94½	93 94½
Florida Power & Light	5s	1954 *k* 93½	93½ 93½
Florida Publ. Service	6s	1955 96½	*n* 96½ *n* 99
Florida Public Service	6½s	1949 99½	*n* 99 *n*103
Ft. Smith Lt. & Trac.	5s	1936 75½	75½ 78
Ft. Worth Pwr. & Lt.	5s	1931 99½	*n* 99 *n*100½
GALVESTON ELEC.	5s	1940 90	*n* 86½ *n* 93½
General Elec.	3½s	1942 87	87½ 88½
Georgia Carolina Pwr.	5s	1952 86½	*n* 82 *n*90
Ga. Lt., Pwr. & Rys.	5s	1941 87½	*n* 80½ *n* 90½
Ga. Ry. & Elec.	5s	1932 98½	*n* 98½ *n*100½
Ga. Ry. & Elec.	5s	1949 92½	*n* 88 *n* 94½
Ga. Ry. & Pwr.	5s	1954 95½	*n* 89½ *n* 96
Ga. Ry. & Pwr.	6s	1947 *k*104	....
Ga. Ry. & Pwr.	7s	1941 *k*105	....
German Gen. Elec.	7s	1945 97½	95 97½
German Gen. Elec.	6½s	1940 97½	93½ 97½
Great Cons. Elec. Pwr. (Japan)	6½	1950 *k* 86	85½ 86
Great Cons. Elec. Pwr. (Japan)	7s	1944 91½	91 92½
Great Falls Pwr.	5s	1940 101½	101½ 103½
Great Northern Pwr.	5s	1935 99½	*n* 96 *n*100
Great Western Pwr.	5s	1946 *k* 99½	....
Great Western Pwr.	5½s	1955 99	*n* 96 *n* 99½
Great Western Pwr.	6s	1949 *k*102	....
Great Western Pwr.	6s	1952 102	*n* 99½ *n*102½
HAMBURG ELEC.	7s	1935 *k* 95½	94 95½
Havana Elec. R., Lt. & P.	5s	1954 92½	92½ 93½
Holtwood Pwr.	6s	1954 103½	*n*100 *n*104½
Houston Ltg. & Pwr.	5s	1931 100½	*n* 98½ *n*101
Houston Ltg. & Pwr.	5s	1953 95	*n*90½ *n*95½
Houston Ltg. & Pwr.	5½s	1954 101½	*n* 97 *n*102½
Hydraulic Pwr.	5s	1951 101	*n* 99½ *n*102
Hydraulic Pwr.	5s	1950 101	*n*100 *n*103
IDAHO PWR.	5s	1947 96½	*n* 93 *n* 97½
Ill. Elec. Pwr.	6s	1943 102½	*n* 99½ *n*103½
Ill. Pwr.	5s	1933 93½	*n* 93 *n* 95½
Ill. Pwr.	6s	1944 *k* 98	....
Ill. Pwr. & Lt.	5½s	1954 97½	*n* 97½ *n* 98½
Ill. Pwr. & Lt.	6s	1953 101	*n*100½ *n*102½
Ill. Pwr. & Lt.	7s	1953 103	*n* 99 *n*104
Ind. Elec.	6s	1947 98	*n* 96 *n* 99½
Ind. Gen. Serv.	5s	1948 97	*n* 92 *n* 97½
Ind. Lighting	4s	1958 83½	*n* 78 *n* 84
Indiana & Mich. Elec.	5s	1957 99½	*n* 97½ *n* 99½
Indiana & Mich. Elec.	5s	1955 97½	*n* 95 *n* 98
Ind. Pwr.	7½s	1941 *m*105½	*n*104 *n*106
Ind. Service	5s	1950 92	*n* 86½ *n* 92
Ind. Service	6s	2020 87½	*n* 73 *n* 88½
Ingersoll-Rand	5s	1935 100	....
Interstate Elec.	6s	1933 95	*n* 95 *n* 99½
Interstate Pwr.	6s	1944 *k* 97½	....
Interstate Pwr.	7s	1934 *k*101	....
Interstate Pub. Serv.	6s	1948 98½	*n* 96 *n*100½
Iowa Ry. & Lt.	5s	1932 98½	*n* 97 *n* 99½
Iowa Southern Utilities	5½s	1950 95	*n* 92½ *n* 97½
JERSEY CENT. PWR. & LT.	5½s	1945 95½	*n* 95 *n* 98
KANSAS CITY PWR. & LT.	5s	1952 101½	100½ 101½
Kansas Elec. Pwr.	6s	1937 100½	*n* 97½ *n*102
Kansas Elec. Pwr.	6s	1943 100½	*n* 97½ *n*102
Kansas Gas & Elec.	6s	1952 102½	101½ 103½
Kansas Gas & Elec.	6s	2022 92	*n* 86½ *n* 94½

Stock Exchange: *c*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Mont real; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Monday, Feb. 8. *l*Bid, low, high, Tuesday, Feb. 9. *m*Latest quotations available, *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday Feb. 6	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	100¼	n 99½	n101
Kentucky Utilities.....	6s	1949	100¼	n 97	n101¼
Kings Cty. Elec. L. & P..	5s	1937	102¼	102	102½
Kings Cty. Elec. L. & P..	6s	1997	123	120½	122½
Kings County Ltg.....	5s	1954	100	98½	100¾
Kings County Ltg.....	6‡s	1954	108½	107	108½
Knoxville Ry. & Lt.....	5s	1946	95½	n 88	n 95½
LACLEDE GAS LT.....	5s	1934	100½	100½	101½
Laclede Gas Lt.....	5‡s	1953	103½	102¼	104
Laurentian Pwr.....	6s	1936	100	n 96	n100½
Laurentide Pwr.....	5s	1946	99½	n 97	n100½
Lehigh Pwr. Sec. (notes).	6s	1927	100½	100¼	101¼
Lehigh Pwr. Sec.....	6s	2026	k 95½	25¼	95½
Lincoln Gas & Elec.....	5s	1941	93	n 91	n 95½
Long Island Ltg.....	5s	1936	k100	....	....
Long Island Ltg.....	6s	1954	100½	100	101
Long Island Ltg.....	6s	1948	105½	n102	n105¼
Los Angeles Gas & Elec..	5s	1939	k 99½	....	....
Los Angeles Gas & Elec..	5‡s	1943	100	n 94	n 99½
Los Angeles Gas & Elec..	5‡s	1947	k100½	....	....
Los Angeles Gas & Elec..	5‡s	1949	100	n 95½	n 99½
Los Angeles Gas & Elec..	6s	1942	103½	n101¼	n104½
Louisiana Pwr.....	6s	1944	98½	n 97	n 99½
Louisville Gas & Elec....	5s	1952	k 98¼	....	....
Louisville Gas & Elec....	5‡s	1954	103¾	n 99	n103½
Lower Austrian Hydro El.	6‡s	1944	87½	87½	87½
Luzerne Cty. Gas & El...	5s	1948	98	n 97	n 99½
Luzerne Cty. Gas & El...	7s	1944	104¼	n 99½	n104½
Luzerne Cty. Gas & El...	6s	1954	103½	n 99	n105
MADISON RIV. PWR..	5s	1935	100½	n 99½	n101
Manila Elec.....	7s	1942	102½	102	103
Manila Elec. Ry. & Ltg..	5s	1953	90½	89½	91½
Manitoba Pwr.....	7s	1941	105	103½	105½
Memphis Pwr. & Lt.....	5s	1948	99½	n 95	n 99½
Metropolitan Edison.....	6s	1952	105¼	104	106
Metropolitan Edison.....	5s	1953	97½	96½	98
Metropolitan Pwr.....	6s	1953	104	102	104
Michigan Lt.....	5s	1946	99½	n 97½	n100
Michigan No. Pwr.....	5s	1941	98	n 95½	n 99
Milwaukee El. Ry. & Lt..	5s	1926	m 99½	99½	99½
Milwaukee El. Ry. & Lt..	4‡s	1933	98½	98	99
Milwaukee El. Ry. & Lt..	5s	1951	99½	98½	99½
Milwaukee El. Ry. & Lt..	5s	1961	93	90½	93½
Milwaukee El. Ry. & Lt..	6s	1953	103½	100½	104
Minn. Pwr. & Lt.....	5s	1955	96½	n 95	n 97
Minn. Pwr. & Lt.....	6s	1950	105	n101¼	n105½
Miss. Power.....	5s	1955	93½	n 91	n 93
Miss. River Pwr.....	5s	1951	k 99½	....	....
Miss. River Pwr.....	7s	1935	102	n102	n104
Mo. Edison Elec.....	5s	1927	b100½	100½	100½
Mobile Elec.....	5s	1946	k 98¼	....	....
Monongahela W. Pa. Pub. Service.....	5‡s	1953	95½	n 95	n 97½
Montana Pwr.....	5s	1943	101	99½	101
Montgomery Lt. & W.P..	5s	1943	m 93	n 86½	n 93½
Montreal Lt., Ht. & Pwr.	4‡s	1932	97	n 97	n 98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	n 98½	n101
Montreal Pub. Serv.....	5s	1942	94½	n 89	n 94½
Mountain States Pwr.....	6s	1938	99	n96½	n100½
NASHVILLE RY. & LT.	5s	1953	97½	n 94	n 99
Nashville Ry. & Lt.....	5s	1958	91	n 84	n 92
Nassau Lt. & Pwr.....	5s	1927	99½	n 98	n101
Nassau & Suffolk Ltg....	5s	1945	90	n 82	n 91
National Elec. Power....	6s	1945	92½	n 92	n 97
National Pwr. & Lt.....	7s	1972	k103¼	....	....
National Pub. Serv.....	6‡s	1955	95	n 94	n 97½
Nebraska Pwr.....	5s	1949	99½	n 97	n100½
Nebraska Pwr.....	6s	2022	95	n 89½	n 97½
Nevada-Calif. Elec.....	6s	1946	k 99½	....	....
Nevada-Calif. Elec.....	6s	1950	99½	n 96½	n100½
New Brunswick Pwr.....	5s	1937	82	n 81	n 82½
New England Pwr.....	5s	1951	101½	n100½	n103
New Jersey Pwr. & Lt....	5s	1936	97½	n 92½	n 97½
New Orleans Pub. Serv...	4‡s	1935	87	n 83½	n 88½
New Orleans Pub. Serv...	5s	1952	92½	90½	93
New Orleans Pub. Serv...	5s	1955	92½	90½	92½
New Orleans Pub. Serv...	6s	1949	90½	n 86½	n 93½
N.Y. & Queens El. L.&P..	5s	1930	102½	100½	103½
N.Y. & Westchester Ltg..	4s	2004	80½	n 76	n 81
N.Y. & Westchester Ltg..	5s	1954	98	n 93	n98½
New York Edison.....	6‡s	1941	115½	115½	116½
New York Edison.....	5s	1944	103	102	103½
N.Y. Gas & El. L. H.&P.	5s	1948	104½	104	105
N.Y. Gas & El. L. H.&P.	4s	1949	90½	89½	90½
N.Y. State Gas & Elec...	5‡s	1962	100½	n 96	n101½
Newport News & Hampton Ry., Gas & Elec....	5s	1944	89½	n 84	n 93
Niagara Falls Pwr.....	5s	1932	100½	101	102
Niagara Falls Pwr.....	6s	1932	105	105	106½
Niagara Falls Pwr.....	6s	1950	105½	n105½	n106½
Niagara, Lock. & Ont. Pwr.	5s	1954	m 98¾	n104½	n110
Niagara, Lock. & Ort. Pwr.	5s	1955	100	99	100½
Niagara, Lock. & Ont. Pwr.	6s	1958	m109½	n104½	n110½
Norfolk Ry. & Lt.....	5s	1949	95	n 93	n 96
No. Amer. Edison.....	6s	1952	103½	101½	104
No. Amer. Edison.....	6‡s	1948	105½	103½	106
No. Amer. Lt. & Pwr.....	7s	1954	99½	n 97	n100½
North Caro. Pub. Serv...	5s	1934	k 93	....	....
North Caro. Pub. Serv...	6s	1954	94½	n 91½	n 96
North Caro. Pub. Serv...	6‡s	1944	99	n 96	n100
North Shore Elec.....	5s	1940	99½	n 97½	n100
No. Calif. Pwr.....	5s	1948	100	n 98½	n100½
No. Ind. Gas & Elec.....	5s	1929	99	n 97	n100½
No. Ind. Gas & Elec.....	6s	1952	103½	n 99½	n103½
Northern N. Y. Utilities..	5‡s	1949	100	n 96½	n100½
No. Ohio Pwr.....	7s	1935	k 96	....	....
No. Ohio Trac. & Lt.....	4s	1933	87	n 82	n 87½
No. Ohio Trac. & Lt.....	5s	1956	83½	n 78	n 87
No. Ohio Trac. & Lt.....	6s	1926	99	n 98½	n100
No. Ohio Trac. & Lt.....	6s	1947	94	92½	95½
No. Ontario Lt. & Pwr...	6s	1931	m100	n 95½	n100½
No. States Pwr.....	6‡s	1933	124½	123	131
No. States Pwr. (notes)....	6‡s	1933	103½	103	104½
No. States Pwr.....	6s	1948	k103	....	....
No. States Pwr.....	6s	1941	k105½	....	....
No. States Pwr.....	5s	1941	k 98½	....	....
No. Tex. Elec.....	5s	1940	70	n 72	n 82½
Northwestern Elec.....	6s	1935	102½	n101½	n102½
Northwestern Pub. Serv..	6‡s	1948	99½	n 97½	n100½
Nova Scotia Tr. & Pwr...	5s	1946	88	n 84	n 89
OHIO PWR.....	5s	1952	k 94½	94½	95
Ohio Pwr.....	6s	1953	104	n101	n104½
Ohio Pwr.....	6s	2024	96	n 88½	n 95½
Ohio Pwr.....	7s	1951	105½	n105½	n107½
Ohio Pub. Serv.....	5s	1954	93	n 87	n 93
Ohio Pub-Serv.....	6s	1953	100½	n 99	n101½
Ohio Pub. Serv.....	7‡s	1946	112½	112½	113½
Ohio Pub. Serv.....	7s	1947	110½	110½	111½
Ohio River Edison.....	6s	1948	102½	102	104
Okla. Gas & Elec.....	5s	1950	93½	n 91½	n 95
Okla. Gas & Elec.....	6s	1940	95½	n 95½	n 98½
Ontario Pwr. of Niagara Falls.....	5s	1943	100½	99½	101
Ontario Transmission.....	5s	1945	99½	99½	99½
Ozark Pwr. & Wtr.....	5s	1952	76½	n 75	n 79
PACIFIC COAST PWR..	5s	1940	99½	n 98	n100
Pacific Gas & Elec.....	5s	1942	k 98½	....	....
Pacific Gas & Elec.....	5s	1955	m 93½	n 94	n 95½
Pacific Gas & Elec.....	5‡s	1952	k102½	....	....
Pacific Gas & Elec.....	6s	1941	k106½	....	....
Pacific Lt. & Pwr.....	5s	1942	k100½	....	....
Pacific Lt. & Pwr.....	5s	1951	100½	n 98½	n100½
Pacific Pwr. & Lt.....	5s	1930	k 99½	....	....
Pacific Pwr. & Lt.....	5s	1953	m 96½	....	....
Parr Shoals Pwr.....	5s	1952	96	n 92½	n 97
Paterson & Passaic G.&E.	5s	1949	100½	100	100½
Penn Central Lt. & Pwr...	6s	1953	103½	n102	n104½
Penn Edison.....	5s	1946	98	n 93½	n 97½
Penn Elec.....	6‡s	1954	98	n 96	n 99½
Penn. Elec.....	6s	1955	93	n 91½	n 95
Penn.-Ohio Edison.....	6s	1950	k105	98½	106
Penn Ohio Elec.....	6‡s	1938	107	n 99½	n106
Penn Ohio Pwr. & Lt.....	5‡s	1954	k 99½	....	....
Penn Ohio Pwr. & Lt.....	6s	1939	97½	n 94	n 99½
Penn Pwr. & Lt.....	5s	1952	98½	98	99
Penn Pwr. & Lt.....	5s	1953	98½	98	99
Penn Pwr. & Lt.....	6s	1953	104½	n102½	n105½
Penn Pwr. & Lt.....	7s	1951	106	n105½	n107
Penn Pub. Serv.....	5s	1954	95½	n 93	n 96½
Penn Pub. Serv.....	6s	1947	104	n103	n105½
Penn Wtr. & Pwr.....	5s	1940	102	n 99½	n102½
Penn Wtr. & Pwr.....	5‡s	1953	102½	n100	n103½
Phila. Co.....	6s	1944	105	103½	105
Phila. Co.....	5‡s	1938	100	98¼	100½
Phila. Co.....	5s	1951	96½	n 93½	n 97
Phila. Co.....	5s	1949	m102½	n 94½	n104
Phila. Elec.....	5s	1966	c104½	102½	104½
Phila. Elec.....	4s	1966	m 85	85	85
Phila. Elec.....	5s	1960	c103	102	103
Phila. Elec.....	6s	1941	c108½	107½	108½
Phila. Elec.....	5‡s	1947	c107	106½	107½
Phila. Elec.....	5‡s	1953	c107	106½	107½
Portland Elec. Pwr.....	6s	1947	100	99	100½
Portland Gen. Elec.....	5s	1935	100½	99½	100½
Portland Ry., Lt. & Pwr..	5s	1942	90½	88½	93
Portland Ry., Lt. & Pwr..	6s	1947	100	99	100½
Portland Ry., Lt. & Pwr..	7‡s	1941	107	106½	108
Potomac Edison.....	6s	1949	99½	n 96	n100½
Potomac Edison.....	6‡s	1948	103	n 99	n104
Potomac Elec. Pwr.....	5s	1929	j100½	....	....
Potomac Elec. Pwr.....	5s	1936	j100½	....	....
Potomac Elec. Pwr.....	6s	1953	j107	....	....
Potomac Elec. Pwr.....	7s	1941	j106½	....	....
Power Corp. of N. Y.....	6s	1942	101	n 97	n101½
Power Corp. of N. Y.....	6‡s	1942	104½	n101½	n105½
Power Securities.....	6s	1949	k 77	....	....
Pub. Lt. & Pwr.....	5s	1945	69	n 64	n 79
Pub. Serv. Co. of Colo....	5‡s	1954	94½	n 92	n 96
Pub. Serv. Co. of Colo....	6s	1953	99½	n 98	n101
Pub. Serv. Co. of Colo....	7s	1933	101½	n 98½	n102½
Pub. Serv. Corp. of N.J..	5s	1959	105	104½	105
Pub. Serv. Corp. of N.J..	6s	1944	102	100	102
Pub. Serv. Co. of No. Ill..	5s	1956	98½	n 91	n 98
Pub. Serv. Co. of No. Ill..	5‡s	1962	103½	n 96½	n102½
Pub. Serv. Co. of No. Ill..	5‡s	1964	103½	n 96½	n102½
Pub. Serv. Co. of Okla....	6s	1949	99	n 97½	n101
Pub. Serv. Elec. & Gas..	5‡s	1959	104½	103½	105
Pub. Serv. Elec. & Gas ..	5‡s	1964	104½	103½	105
Pub. Util. Evansville, (Ind.)	6s	1929	100	n 99	n101
Puget Sound Pwr.....	5s	1933	98½	n 98½	n100½
Puget Sound Pwr. & Lt...	5‡s	1949	100½	n 96½	n100½
QUEBEC PWR.....	6s	1953	102½	n 98½	n102½
Queensborough Gas & E..	5s	1952	99½	n 96½	n100½
Queensborough Gas & E..	6s	1953	104½	n101	n105½
RHINE-WESTPHALIA ELECTRIC PWR....	7s	1950	k 95	93½	95
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	n 85	n 94½
Robbins & Myers.....	7s	1952	66	60	66
Rochester Gas & Elec....	5‡s	1948	105½	105½	106
Rochester Gas & Elec....	7s	1946	113½	112½	114
Rochester Ry. & Lt.....	5s	1954	100	n 99	n101½
Rockford Elec.....	5s	1939	99½	n 98	n101
ST. MAURICE PWR...	6‡s	1953	108½	n107	n109
St. Paul Gas Lt.....	5s	1944	100½	n 98½	n101½
St. Paul Gas Lt.....	5‡s	1954	101½	n 98	n102½
St. Joseph Ry., Lt. H.&P.	5s	1937	93	91½	97
Salt River Valley Wtr....	6s	1938	k100	....	....
Salmon River Pwr.....	5s	1952	100½	n 98½	n101½
San Antonio Gas & Elec..	5s	1949	96½	n 96	n 98½
San Antonio Pub. Serv...	6s	1952	102½	101½	102½
San Diego Cons. G.& E....	5s	1939	100½	n 98	n101
San Diego Cons.G.&E....	6s	1939	101½	n 99	n103
San Joaquin Lt. & Pwr..	5s	1945	98½	n 98	n100
San Joaquin Lt. & Pwr..	6s	1950	103½	n101	n103½
San Joaquin Lt. & Pwr..	6s	1952	101½	n 99½	n103½
San Joaquin Lt. & Pwr..	6s	1954	101½	n 99	n101½
Sauda Falls.....	5s	1955	k 95	94½	95½
Savannah Elec. & Pwr....	7‡s	1941	k104½	....	....
Saxon Pub. Wks. (Germany).....	7s	1945	94½	92½	94½
Scranton Electric.....	5s	1937	102	n 99½	n102½
Seattle Elec.....	5s	1930	100½	n 99½	n101
Seattle Elec.....	5s	1929	99½	n 99	n100½
Seattle Elec.....	5s	1939	92½	n 90	n 93½
Seattle Ltg.....	5s	1949	91½	n 85½	n 93
Shawinigan Wtr. & Pwr..	5s	1934	100½	n100	n101½
Shawinigan Wtr. & Pwr..	5‡s	1950	104	n101½	n104½
Shawinigan Wtr. & Pwr..	6s	1950	105	n104½	n106½
Sheboygan Elec.....	5s	1946	95½	n 94	n 97
Siemens & Halske.....	7s	1928	k100	96½	100
Siemens & Halske.....	7s	1935	94½	94	95½
Sierra & San Fran. Pwr...	5s	1949	k 77½	....	....
Sierra & San Fran. Pwr...	6s	1949	90	n 87	n 93½
Sioux City Gas & Elec....	6s	1947	102	n 99	n102½
Sioux City Gas & Elec....	6s	1949	102½	n 99	n102½
So. Caro. Gas & Elec.....	6s	1942	82	n 87	n 93
So. Caro. Gas & Elec.....	6s	1932	75	n 78	n 88
Southeast Pwr. & Lt.....	6s	2025	91½	n 88	n 92
So. Cal. Edison.....	5s	1939	k 99½	....	....
So. Cal. Edison.....	5s	1944	97½	n 92½	n 97
So. Cal. Edison.....	5‡s	1944	102½	n 98½	n102
So. Cal. Edison.....	6s	1943	102½	n100½	n104
So. Cal. Edison.....	6s	1944	k105	....	....
So. Cities Utilities.....	8s	1931	98	n 99	n102
Southern Colo. Power....	6s	1947	k 98½	....	....
So. Ind. Gas & Elec.....	6s	1947	k97½	....	....
Southern Pwr.....	5s	1930	100	n 99	n101
So. Public Utilities.....	5s	1943	100½	n 97½	n100½
So. Sierras Pwr.....	6s	1936	102½	n102	n104½
So. Utilities.....	6s	1933	m102	n 97½	n102½
So. Wisconsin Pwr.....	5s	1938	91½	n 88	n 93
Southwestern Gas & E....	5s	1932	96½	n 94	n 98
Southwestern Gas & E....	6s	1957	97½	n 89	n 98
Southwestern Lt. & Pwr..	6s	1937	97½	n 94½	n 99
Southwestern Power.....	6s	1944	96½	n 96	n 98
Southwestern Pwr. & Lt..	5s	1943	94½	n 90	n 97
Southwestern Pwr. & Lt..	6s	2022	92½	n 88½	n 94½
Southwestern Pub. Serv..	6s	1945	94	n 94	n 99
Southwestern Utilities....	8s	1936	95	n 96	n102
Springfield Ry. & Lt.....	5s	1926	99½	n 98½	n100½
Standard Elec. of Cal....	5s	1939	100	n 98½	n100½
Standard Gas & Elec.....	6s	1935	k 99½	....	....
Staten Island Edison.....	6‡s	1953	106	n104	n107
Superior Water, Lt. & Pwr.	4s	1931	94½	n 93	n 95
Syracuse Ltg.....	5s	1951	100½	100½	100½
Syracuse Ltg.....	5‡s	1954	103	n100½	n103½
TAMPA ELEC.....	5s	1933	k 99	....	....
Tenn. Elec. Pwr.....	6s	1947	104½	102½	104½
Tenn. Pwr.....	5s	1962	95½	n 90	n 96½
Tex. Pwr. & Lt.....	5s	1937	99	n 97	n 99½
Tex. Pwr. & Lt.....	6s	2022	94½	n 90	n 97½
Tide Water Pwr.....	6s	1942	99½	n 98½	n101
Tide Water Pwr.....	7s	1937	99	n 97½	n101½
Toho Elec. Pwr. (Japan)..	7s	1955	m 90½	n 87	n 91½
Tokyo Elec. (Japan).....	6s	1928	m 97½	97	97½
Toledo Edison.....	5s	1947	99½	n 97	n100
Toledo Edison.....	7s	1941	109	108½	109½
Toledo Gas, Elec. & Htg.	5s	1935	98	n 97	n100½
Toledo Tr., L.&P. (notes)	5‡s	1930	98½	98	99
Topeka Edison.....	5s	1930	99	n 97	n100
Topeka Ry. & Lt.....	5s	1933	94½	n 90½	n 96½
Trenton Gas & Elec.....	5s	1949	100½	100½	100½
Tri-City Ry. & Lt.....	5s	1930	k 98	....	....
Twin State Gas & Elec....	5s	1953	95½	n 84	n 94½
Twin State Gas & Elec....	5‡s	1945	97½	n 96	n 98½
Tyrol Hydro-Elec. Pwr...	7‡s	1955	m 96½	n 94½	n 97
UJIGAWA ELEC PWR.	7s	1945	92½	n 90	n 92
Union Elec. Lt. & Pwr....	5s	1932	101½	100½	101½
Union Elec. Lt. & Pwr....	5s	1933	100½	100½	100½
Union Elec. Lt. & Pwr....	5s	1954	99½	n 97½	n100
Union Elec. Lt. & Pwr....	5‡s	1954	101½	100½	102½
United Elec. of N.J.....	4s	1949	87½	n 85	n 89
United Elec. Lt. & Pwr...	4‡s	1929	98	n 96	n100
United Gas & Elec.....	6s	1945	101½	n 96	n101
United Lt. & Pwr. (notes)	5‡s	1928	99½	n 98	n100
United Lt. & Pwr.....	5‡s	1959	96½	n 90½	n 97½
United Lt. & Pwr.....	6‡s	1974	97½	n 92½	n 97½
United Lt. & Rys.....	5s	1932	96½	n 92½	n 97½
United Lt. & Rys.....	6s	1926	100	n100½	n101½
United Lt. & Rys.....	6s	1952	99½	n 95½	n100½
United Lt. & Rys.....	6s	1973	89½	n 87	n 92
United Pwr. & Lt.....	6s	1944	102½	n 99	n103
United Water, G. & E....	5s	1941	93½	n 92	n 94
Utah Lt. & Trac.....	5s	1944	88½	86½	89½
Utah Pwr. & Lt.....	5s	1944	96	95	97
Utah Pwr. & Lt.....	6s	1944	103	n102	n104½
Utah Pwr. & Lt.....	6s	2022	94	n 88½	n 94½
Utica Elec. Lt. & Pwr....	5s	1950	101½	100½	101½
Utica Gas & Elec.....	5s	1957	101½	100½	101½
Utica Gas & Elec.....	5‡s	1949	103½	n101	n 103½
VERMONT HYDRO-ELEC.....	6s	1929	100½	n 98½	n100½
Vicksburg Lt. & Trac....	5s	1932	92½	n 89	n 93½
Virginian Pwr.....	5s	1942	95	n 94	n 96
Virginian Pwr.....	6‡s	1954	103½	n 99	n103½
Virginia Ry. & Pwr.....	5s	1943	98½	97½	99
Virginia-Western Pwr....	6s	1953	101	n100	n101½
WAGNER EL. MFG...	7s	....	b 100½	100½	100½
Washington Coast Util...	6s	1941	102½	n 99½	n102
Washington Ry. & Elec...	4s	1951	j 80½	....	....
Washington Ry. & Elec...	6s	1933	j 102	....	....
Washington Wtr. Pwr....	5s	1939	103½	101½	102
West Penn Pwr.....	5s	1963	100½	99½	101
West Penn Pwr.....	5s	1946	100½	99½	101
West Penn Pwr.....	5‡s	1953	105½	104½	106
West Penn Pwr.....	7s	1946	106	105½	106½
W. Va. Lt., Ht. & Pwr...	6s	1929	102½	n 95	n101½
West Virginia Utilities....	6s	1935	96½	n 91	n 98
W. Va. Water & Elec....	6‡s	1942	102½	n100	n104
Westchester Ltg.....	5s	1950	102½	102½	103½
Western Elec.....	5s	1944	100½	100½	100½
Western N. Y. Utilities...	5s	1946	97	n 90½	n 97
Western Pwr.....	6‡s	1954	100½	n 97	n101½
Western Pub. Service....	6s	1950	98½	n 96	n 98½
West States Gas & Elec...	5s	1941	98½	n 95	n 99½
West States G.&E. (notes)	6s	1937	94½	n 94	n 97
West States Gas & Elec..	6s	1947	k 99	....	....
West United Gas & El....	5s	1950	100	n 97	n101
West United Gas & El....	6s	1950	102	n100	n102½
Westphalia Un. Elec. Pwr	6‡s	1950	m 87½	n 87½	n 97½
Westinghouse El. & Mfg.	7s	1931	105½	105½	106½
Wheeling Elec.....	5s	1941	97½	n 96	n 99
Wichita R. R. & Lt.....	5s	1932	84	n 83	n 88
Winnipeg Elec.....	6s	1954	96½	n 93	n 99½
Wisconsin Elec. Pwr.....	5s	1954	99	n 93½	n 99
Wisconsin Gas & Elec....	5s	1952	k 99½	....	....
Wis.-Minn. Lt. & Pwr....	5s	1944	k 95	....	....
Wisconsin Pwr., Lt. & Ht	5s	1946	92	n 87	n 93
Wisconsin Pub. Service...	6s	1952	101½	n 99	n102½
Wis. Ry., Lt. & Pwr.....	5s	1933	92½	n 87½	n 93½
Wis. River Pwr.....	5s	1941	93	n 88	n 92½
Wolverine Pwr.....	7s	1943	100	n 99	n101½
YADKIN RIVER PR..	5s	1941	k 99½	....	....
Yarmouth Lt. & Pwr.....	5s	1937	83	n 82	n 87
Yarmouth Lt. & Pwr.....	8s	1951	99	n 97	n102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dPoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Monday, Feb. 8. lBid, low, high, Tuesday, Feb. 9. mLatest quotations available, n1925.

Manufacturing and Markets

Reducing Waste in Multiple Bidding

British Practice Said to Reduce Cost to Economic Level—Purchaser Pays Cost of Quotations as Definite Percentage Rather than as a Hidden Charge

ECONOMIC waste resulting from purchasers asking quotations from manufacturers with whom they have no intention of doing business has existed for some time in the purchase of electrical machinery and equipment. Cases are not infrequent in which the total expense to all manufacturers in preparing quotations on a particular job has exceeded the value of the job itself. Any number of cases exist in which the combined engineering expense incident to the preparation of quotations by a multitude of manufacturers has exceeded by a large margin the greatest possible profit that the successful bidder could hope to make. In such cases the successful bidder may or may not have made a profit, and the purchaser may believe he has driven a good bargain; but the fact remains that the industry as a whole has suffered a loss, and this loss must be made up in subsequent higher prices for future quotations by all manufacturers.

Expense Made Part of Price

What appears to be a successful solution of this problem of waste in multiple bids has been found in a British practice reported as being used in several branches of industry. Briefly, the plan is as follows: First, the purchaser must announce the number of bidders; second, each bidder adds to his quotation 1 per cent for every bid requested by the purchaser; third, the successful bidder returns to each of the unsuccessful bidders 1 per cent of the contract price. For example, a power company wishes to build a substation and sends a request for quotations to twelve manufacturers. The number of bidders is announced to all manufacturers sending in quotations. Each manufacturer then adds to his quotation 12 per cent to cover the cost of preparing the bid. The successful bidder gets the contract at 12 per cent above his net price, exclusive of charge for engineering. He then returns to each of the other eleven bidders 1 per cent of the contract price. If there were twenty quotations received, 20 per cent would be added to all bids and the successful bidder would return 1 per cent to each of the other nineteen bidders.

The working of this plan in England is said to have had a salutary effect upon those purchasing agents who are inclined to ask for more bids than are necessary to get a reasonable price and who encourage unnecessary expense upon the part of a great many manufacturers with whom the purchaser has no intention of doing business. Under this plan it would be unlikely that any purchaser would want to be responsible for a waste in engineering effort in the form of superfluous quotations. It must be noted that the plan cannot be considered as adding one dollar to the actual cost of equipment, provided the proper number of bidders is selected. This added charge is for engineering and quotation expense only, and the successful bidder gets only 1 per cent more than his net price. The other manufacturers are merely partially reimbursed for their expense in the preparation of the quotation.

This plan should encourage engineering development by the small manufacturer. It is common knowledge that small manufacturers having features of real merit in their design may be unable to afford to spend much money in engineering and other expense incident to the preparation of quotations (quotation expense on a hundred-thousand-dollar job may reach $5,000 or more). Progress in the development of apparatus and the art of application should be greatly accelerated by some plan, such as that just outlined, whereby the manufacturer with good apparatus but less working capital would be encouraged to spend additional money in adapting his equipment to the particular needs of the purchaser. At present many of these smaller but qualified manufacturers are prevented from attempting to bid on jobs that they could well handle if it were not for the uncertainty of getting back money spent on special engineering and quotation work.

Successful Price Disclosed

What some manufacturers might consider a disadvantage of this plan is the fact that it discloses the price quoted by the successful bidder. Not so long ago this would have been considered an insurmountable obstacle to the success of any such plan. However, the present tendency toward the adoption of net price sheets by manufacturers shows that less importance is attached to secrecy on quotations. One manufacturer of high-tension equipment has recently adopted net price sheets on standard outdoor substations, with the prices guaranteed for as long as six months in advance This would indicate that there is no real harm to be expected from the disclosure of the prices at which successful bidders obtain contracts for equipment.

Most purchasers and manufacturers will agree that a request for a quotation is a request for the expenditure of time and money. Does it not seem fair that the one making the request should be responsible for repayment? Superficially the purchaser does not have to meet this expense, but virtually every quotation must include it. A

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

Division	December 1924	December 1925	Per Cent Increase or Decrease	For Entire Year 1924	For Entire Year 1925	Per Cent Increase or Decrease
New York	303	259	—14.5	4,050	4,129	+ 1.9
Middle and Southern Atlantic States	182	180	— 1.1	2,816	2,695	— 4.3
New England	50	80	+60.0	700	985	+40.7
Pacific Coast	29	37	+27.6	268	241	—10.0
Central	694	947	+36.4	10,179	10,521	+ 3.3
Total	1,258	1,503	+19.5	18,013	18,571	+ 3.1

TOTAL AMOUNTS REPORTED

Division	December 1924	December 1925	Per Cent Increase or Decrease	For Entire Year 1924	For Entire Year 1925	Per Cent Increase or Decrease
New York	$40,897	$34,902	—14.6	$596,642	$580,962	— 2.7
Middle and Southern Atlantic States	21,040	18,931	—10.0	315,596	335,902	+ 6.4
New England	5,458	6,689	+22.5	76,961	104,476	+35.8
Pacific Coast	4,495	5,018	+11.6	34,093	31,791	+ 6.7
Central	88,782	118,558	+33.5	1,217,816	1,308,957	+ 7.5
Total	$160,672	$184,098	+14.6	$2,241,078	$2,362,088	+ 5.4

AVERAGE AMOUNTS

Division	December 1924	December 1925	For Entire Year 1924	For Entire Year 1925
New York	$135	$135	$147	$140
Middle and Southern Atlantic States	115	106	112	125
New England	109	84	110	106
Pacific Coast	155	136	127	132
Central	128	126	120	125

plan such as here outlined should help the purchaser to arrive at an economic balance between the excessive cost due on the one hand to unnecessary quotations and on the other hand to the absence of competition. The purchaser would request bids only from firms with which he would be willing to do business. This plan should effectively eliminate the unethical and uneconomic practice of asking bids from certain classes of manufacturers for the sole purpose of hammering down prices. Hammered-down prices are no better for the purchaser in the long run than they are for the manufacturer.

Electric Industrial Trucks

The number of electric industrial trucks and tractors shipped by the eight leading manufacturers in the industry, as shown in the accompanying table, has been announced by the Department of Commerce. The table shows the figures for each quarter of 1925 and for the months of October, November and December, 1925. Because of the diversity of manufacturing demands electric industrial trucks are built mainly to meet special requirements, so that aside from the various units which are common to all types of trucks built by any particular manufacturer, many types are required to satisfy the needs of industry.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

	Domestic		
1925—Quarter Ended	Tractors	All Other Types	Exports
March 31	42	251	41
June 30	49	277	50
Sept. 30	56	283	12
Dec. 31	40	292	24
Total	187	1,103	127
October	16	107	5
November	11	101	9
December	13	84	10

Business Conditions

STEADY buying is reported in the electrical industry virtually throughout the country. Industrial plants are placing orders and the activity of such firms is expected to be maintained. The demand is greater than in several months, and many inquiries continue to be received. Developments in Florida are reflected in purchases by holding companies, an interesting order being for electric baking ovens for hotels. Contemplated new construction announced by a central-station company in that territory includes many miles of transmission lines and steam generating plants aggregating 85,000 hp. Central-station buying is good, though no large orders are reported.

In New England good sales of power equipment were made, particularly to industrial plants, and the market is more active than for some time. Sales of small motors are reported as very encouraging. An industrial plant to be erected at Worcester, Mass., will require about $250,000 worth of electrical equipment. Central-station buying in the New York district is improving, and there is an active demand for pole-line hardware. There have been good sales of small motors to the clothing trade and to domestic refrigerator manufacturers, and the trend of industrial buying is healthy and is expected to maintain its present activity. In the Southeast the volume of business is being sustained, and many plans for execution in the spring presage a continued demand. Good sales are reported in the Middle West, with the tendency toward conservative buying not so apparent, and larger orders are being placed. On the Pacific Coast machinery and power apparatus are in demand, and indications point to much lateral and subsidiary line construction. Sales to lumber companies in the Northwestern section are good, but this is not the case in California, where sales are below expectations at this period.

Copper Sales in Large Volume—Zinc Weakens

THE volume of copper business has been excellent, with firmer prices but lighter buying during the last few days. The copper is strong but lead and zinc are in weak demand, particularly the latter. Rumors of the proposed Copper Export Association that became more insistent last Thursday, though not mentioned officially until Tuesday, had a bullish effect on the London market and this was reflected in extremely heavy buying in the domestic market. More metal was sold on Thursday than during entire weeks in recent months. Prices ranged from 14⅛ cents to 14⅝ cents, the latter representing large sales in the Middle West. Since Thursday several large sellers have been holding at 14⅜ cents, but others have sold freely at 14¼ cents and have taken the business. It is the opinion that 14⅝ cents should represent bottom within a day or two.

NEW YORK METAL MARKET PRICES

	Feb. 3, 1926 Cents per Pound	Feb. 10, 1926 Cents per Pound
Copper, electrolytic	14.075	14.35
Lead, Am. S. & R. price	9⅛	9¼
Antimony	22¼	22
Nickel, ingot	35	35
Zinc, spot	8.35–8.425	8.175
Tin, Straits	62¼	64⅛
Aluminum, 99 per cent	28	28

Base copper price Feb. 10, 1926, 16 cents

The American Smelting & Refining Company continues its official contract price for lead at 9¼ cents. The continued decline in the London market, especially for spot lead, is having a slightly weakening influence on the New York lead market. A prominent electrical company has bought a substantial tonnage in the last two or three days at 9.15 cents, New York, and other consumers have also been quoted this price for any delivery.

Volume of Business Is Sustained in the Southeast

A VERY satisfactory volume of business is being sustained in the Southeast, though there are no large outstanding orders reported. Considerable plans for execution in the spring are being laid out, and these will call for large quantities of material between now and early summer. Probably the largest of these is the announcement of the Florida Power & Light Company of plans for 1926 calling for the construction of many miles of transmission lines and of steam generating plants aggregating approximately 85,000 hp.

Municipalities and small privately owned power companies are also becoming more active, and jobbers report reasonably satisfactory orders already being received for distribution-line materials. Quite a number of moderate sized "white-way" equipment orders are reported, with excellent prospects for continued activity in this line. Orders from small contractors are only fair in Atlanta, but the larger contractors doing a state-wide business are buying industrial equipment, and contemplated activities should sustain the volume in this line. The New Orleans territory holds promise of a greatly stimulated activity in wiring and lighting equipment lines on account of new construction soon to be undertaken. Telephone equipment sales are rather quiet, except for orders for small quantities or material for farm lines. Ranges have not yet begun to move in the anticipated spring volume, but proposed campaigns should stimulate the demand. A manufacturer of electric trucks reports having recently placed 38 trucks in West Palm Beach, Fla., with orders in prospect for twelve additional units. Indications are for a banner year in the electric refrigerating line, particularly in sales of the domestic type. A large refrigerator manufacturer reports his business during January as exceeding by 400 per cent that done in the same month last year.

Central-Station Buying Improves in New York District

AN IMPROVEMENT in central-station buying in the New York District is apparent in the last ten days, although no single order of any great magnitude has been reported. The demand for pole-line hardware is active, one manufacturer reporting an increase in sales so far this year of approximately 33 per cent over the corresponding period last year, a considerable amount of this business accruing from holding companies which are buying for Southern properties, and also from the South American trade. There is some local activity, too, as is evidenced by the purchase of distribution transformers ranging in size from 5 kva. to 37.5 kva.

Manufacturers of motors and control equipment report a general improvement in industrial business, with a particular demand for motors of the smaller sizes by the clothing trade. Small motors are also in demand for household refrigerators, oil-burning apparatus, washing machines, etc. Although there are no special features

outstanding, the general trend of industrial buying is healthy and is expected to maintain its present activity. Reports from jobbers indicate a continued inactivity in the demand for materials for building construction, which is partially compensated for by the increase in sales of appliances.

Machinery and Power Apparatus Active on Pacific Coast

MACHINERY and power apparatus business is particularly brisk on the Pacific Coast. One manufacturer reports a good demand for substation transformers in sizes from 1,000 kva. to 2,500 kva. With other indications this points to a great year for lateral and subsidiary line construction. This company also reports a good market for general-purpose motors in sizes from 10 hp. to 30 hp. Another manufacturer reports a recent sale to a lumber company of about 20 motors, sizes from 5 hp. to 20 hp., together with several pumping motors in the Kern district oil fields. Machinery manufacturers report an abnormal number of inquiries and requests for estimates varving from electric dredging and Diesel engine control equipment up to the two big generating stations which are still just short of purchasing.

Power-company inquiries have included 70,000 cross-arm braces and two carloads of 12,500 gal. each of wood preservative. Purchases by such companies are good, though lighter than for several weeks past, and include pole-line hardware in 5,000-piece to 10,000-piece quantities and construction and maintenance tools.

There have been many inquiries for small power and telephone lines. Electrification of lumber-manufacturing plants continues to occupy attention in Seattle. Anticipated orders include about $30,000 worth of motors, ranging from 3 hp. to 400 hp., one 3,000-kw. turbine, oil circuit breakers, etc. A sale of twelve motors from 5 hp. to 75 hp. was reported as made to a spruce mill in Alaska, and a number of smaller motors were purchased by a planing mill at Shelton, Wash. Turbine sales included one 1,000-hp., one 750-hp. and one 250-hp. unit. Five 360-hp. and one 120-hp. Diesel engine—alternator sets were purchased by a railroad. The city of Seattle purchased 8,000 insulators and a carload of cross-arms for local extension work and is expected to be in the market for circuit breakers and transmission wire in the near future.

Buying of Power Equipment in Good Volume in New England

SALES of general-purpose motors were brisk in the New England district, owing to the textile and metal industries overhauling plant equipment and installing new apparatus. The output of one manufacturer is placed at more than 43,000 small motors for the month of January, and the demand, a recorded by this company, is very encouraging. Increased activity in buying large power units is apparent in the record of several recent sales and also in the number of negotiations under way for new projects. One prominent manufacturer reports orders from industrial firms for one 5,000-kw. turbine and another of 3,500-kw. capacity, and an order for a unit of 10,000-kw. capacity is expected to be placed at an early date by a central-station company. Another manufacturer states that turbo-generators continue to attract considerable interest and several sales have been made, one of which was for a 1,000-kw. unit for a B ston fabric company. Florida developments have been reflected favorably in this district and a wide variety of sales is reported. One company records increasing interest in the purchase of electric baking ovens by Southern hotel operators and reports sales of two 60-loaf units during the past week. Extensions of generating stations in Florida are progressing, and a recent addition to the Tampa plant of a 3,500-kw. generator is of interest.

Central-station companies are restocking and are in the market for meters. One order for 4,000 meters was placed recently, and other large orders are under negotiation. Transformers are in steady demand and line material is moving fairly well. A two-million-dollar rod mill will be erected by the American Steel & Wire Company at Worcester, and about $250,000 worth of electrical equipment will be purchased during the coming year in connection with the new plant. Household electrical appliance sales are spotty. One middle Massachusetts central-station company reports 50 per cent increase for the past month as compared with a corresponding month in 1925.

Sales Good in Middle West—Larger Orders Being Placed

GOOD business continues throughout the Middle West, the volume of business holding up well on a steady, even keel. Railroad reports indicate expenditures to be made in this territory this year of several millions of dollars, while industrial activity is noticeably good. The tendency of conservative buying is not so apparent at this time as some of the various utility companies are placing larger commitments, particularly on wire and cable, crossarms and poles. Construction work is necessarily slow at this time, although quite a little rehabilitation work is going on and one utility company in Chicago placed a contract for the construction of a new million-dollar service building this week. Among the interesting orders placed are one for 500,000 lb. of weatherproof wire, another for 1,160 direct-current watt-hour meters and another for code wire approximating $15,000. Jobbers' sales are unusually good, and motors and industrial lighting equipment are in demand. Appliance sales are excellent, with a good movement of washing machines, one jobber placing a single order for 250 machines. There has also been an excellent demand for wiring devices, conduits, etc.

Activities of the Trade

Hubbard Salesmen Hold Second Annual Conference

The second annual sales conference of the electrical materials department of Hubbard & Company was held at the Pittsburgh Athletic Association Jan. 27-30. The conference was arranged by C. L. Peirce, Jr., manager; W. M. Heim, assistant manager; F. E. Norman, manager specialty sales, and A. R. Robitzek, manager hardware sales. The discussions were led by Mr. Heim, chairman. Among the important matters discussed were the sales and advertising program for 1926, territorial analysis, service and the development of new Peirce specialties for distribution work. The annual company banquet, held during the conference, was attended by all of the office employees of the electrical materials department as well as by the salesmen. After the banquet a tour was made through one of the local steel mills.

Hanson, Jones & Morey Announce a Reorganization

With the retirement of R. E. Hanson from the engineering firm of Hanson, Jones & Morey, 810 West Sixth Street, Los Angeles, and the association of Gerald D. Lovell of Los Angeles the company announces a reorganization. The firm is continuing to do business under the name of Morey, Jones & Lovell, with offices at the old address. The company is said to have substantially increased its activities and is now handling the Sievert adjustable flanging machine, for flanging all weights of sheet metal, and automatic oil burners, as well as its previous line of transformer oil-cooling equipment and liquid-flow indicators.

Graybar Electric Announces New Staff Appointments

The new Graybar Electric Company, formerly the supply department of the Western Electric Company, announces several changes in the organization of its department staffs. The new appointees with their staff designation are as follows: W. O. Ramsburg, general service manager, reporting to the vice-president in charge of staff; G. E. Chase, broadcasting sales manager; A. J. Eaves, carrier telephone sales manager, and R. M. Hatfield, public address sales manager. C. E. Reddig has been appointed appliance engineer of the company and will report direct to the manager of the telephone and appliance department. W. A. Fouhy, as the new plant engineer, will supervise plans and construction of the company owned or leased buildings.

The Wagner Electric Corporation, St. Louis, announces that it is placing on the market a new 10-in. three-speed

oscillating fan to retail at $16.50. The company states that this fan compares in quality of materials and workmanship with its larger and higher-priced line.

The Habirshaw Cable & Wire Corporation, 10 East Forty-third Street, New York, through John S. Worley, vice-president and general manager, announces the appointment of Samuel B. Ridge as general sales manager.

Mathias Klein & Sons, 3200 Belmont Avenue, Chicago, manufacturer of linemen's tools, etc., have acquired a tract of land on Wrightwood Avenue, near Crawford Avenue, totaling about 80,000 sq.ft., as a site for a new plant, that it is reported will cost about $100,000, with machinery.

The Standard Electric Stove Company, 1714 N. Twelfth Street, Toledo, Ohio, announces that Fred W. Bagnall, formerly appliance sales manager of the A. T. Knowlson Company, Detroit, has been appointed representative in eastern Michigan with headquarters in Detroit.

The Trumbull Electric Manufacturing Company, Plainville, Conn., manufacturer of electrical supplies, announces that H. S. Hill has been appointed sales representative with headquarters in Atlanta. Mr. Hill will work in the Southeastern territory in connection with Mr. Knoeppel, who has been there for several years and is stationed in Jacksonville, Fla.

The American Steel & Wire Company, 208 South La Salle Street, Chicago, announces that H. S. Durant has been appointed manager of the cold-rolled strip and spring sales department, Chicago, succeeding the late Lewis Johnson.

The Crocker-Wheeler Electric Manufacturing Company, 30 Church Street, New York, has appointed Allen E. Ransom as sales engineer in the New York office. Major Ransom has just completed a contract as industrial sales engineer in the reorganization of the Cleveland and New York offices of Fairbanks, Morse & Company.

The Baldor Electric Company, 4351 Duncan Avenue, St. Louis, announces that the Industrial Electric Equipment Company, 211 Main Street, Buffalo, will act as its representative in the section of New York State west of Utica.

The Simplex Electric Heating Company, Cambridge, Mass., manufacturer of electric heating devices, announces the appointment of W. A. Garside and A. S. Reed as factory representatives and field service men for the New York metropolitan district.

The General Electric Company in February paid supplementary compensation amounting to $1,367,426 to 30,813 employees who have been with the company for five years or more. The sum paid each individual represents 5 per cent of his earnings for the six months ended Dec. 31, 1925. Payments were made in G. E. Employees' Securities Corporation bonds or cash as the employees desired. Both the amount paid and the number of employees benefiting by this plan exceed those of June, 1925.

The Diamond State Fibre Company, Bridgeport, Pa., manufacturer of Diamond fiber and "Celoron," announces the following changes in its Eastern sales organization: C. M. Bogert has been made district manager for Connecticut with offices at South Norwalk, Conn., and W. R. Elsenhans, formerly of the Bridgeport staff, is now district manager at Philadelphia with offices at 822 Drexel Building.

The United Electric Company, Canton, Ohio, announces that Harry A. Duryea, formerly division manager and regional sales director, has been appointed sales manager of the portable cleaner division and Walter C. Wicker has been appointed sales manager of the "Tuec" installed cleaner division.

The Diamond Power Specialty Corporation, Detroit, manufacturer of Diamond soot blowers, announces the appointment of M. J. Miller as sales engineer in charge of the Detroit district. For several years Mr. Miller was in charge of the Philadelphia district of the company.

The Holyoke Company, Inc., Holyoke, Mass., which recently closed negotiations for the purchase of the plant of the Century Machinery Company, is to expand its products and will take up the manufacture of wire for electrical purposes on a large scale. Previously the company manufactured floral wire and millinery wire at the Prentiss wire mills.

The Okonite Company, Passaic, N. J., has received an order from the Puget Sound Power & Light Company for 46,800 ft. of three-conductor submarine armored cable which will be used to span Puget Sound between Edmonds, on the mainland side, and President's Point, on the Olympic Peninsula, and thus connect the properties which the company recently acquired on the peninsula with the mainland system of interconnected power plants. This undertaking was announced in the Dec. 26 issue of the ELECTRICAL WORLD (page 1323). Two cable connections will be made between the points mentioned and each cable will be capable of furnishing 10,000 hp. The total weight of the cable will be approximately 750,000 lb.

The Bristol Company, manufacturer of indicating and recording instruments, has appointed J. L. Williams, formerly in charge of the Denver district, manager of the Boston office, with headquarters at 294 Washington Street.

The General Electric Company has received an order from the Portland (Ore.) Electric Power Company for a 20,000-kw. steam turbo-generator. This unit, although it will operate at 175-lb. pressure when first put in service, is designed to operate at 385 lb., the new pressure under which the company's plant will operate when plans for expansion of the station are completed.

The Westinghouse Electric & Manufacturing Company has obtained a contract through the Pierce Electric Company, Tampa, Fla., for the complete ornamental street lighting of the Davis Islands, Tampa in the Bay, Fla. The contract calls for 1,500 ornamental lighting units, which will be installed in an area of only 875 acres.

The Mill Supply Company, 226 Hill Street, Troy, N. Y., has received a contract awarded by the Municipal Gas Company to change over all the motors in the northern section of Albany from 40-cycle to 60-cycle operation.

New Equipment Available

Fractional-Horsepower Motor

A new line of ball-bearing, fractional-horsepower motors, known as the type "X I B," has been developed and is now being placed on the market by the Baldor Electric Company, 4351 Duncan Avenue, St. Louis. These motors are said to be more compact, lighter and of higher efficiency than the company's standard line of motors as well as being very quiet, there being no magnetic hum or brush squeaks. At no load the ¼-hp., 1,750-r.p.m. motor is said to consume approximately 75 watts, and when fully loaded the input is approximately 270 watts. Under full load the ¼-hp. motor input is about 500 watts.

Panelboard for Industrial Use

A new line of industrial panelboards for the control of lighting systems in offices and factories has recently been announced by the Westinghouse Electric & Manufacturing Company. These panelboards are made in sizes supplying from four to 32 circuits and in capacities ranging from 30 amp. to 100 amp. The new panelboards are of the safety type. They are of unit construction, with eight single-pole or double-pole switches that may be easily removed from the front of the panelboard for inspection or replacement. The trim clamp provided permits easy adjustment of the panelboard trim when the box has been set up out of plumb.

High-Pressure Extraction Heater

A high-pressure extraction closed heater for the regenerative heating of feed water, and which must withstand the full feed-line pressure of 550 lb. per square inch, has been developed by the Cochrane Corporation, Philadelphia. The heater is tested to 1,100 lb. for the water space. It weighs over 14 tons, heavy construction being required to meet the high pressures.

The tube sheets, which are of Muntz metal, are 3¼ in. thick and are faced on both sides. The water boxes and covers, nozzles and rings are of cast steel, while the shell proper is of ⅜-in. steel plate. The water head, which is 4 ft. inside diameter, is held in place by 36 2-in. bolts and is further supported by twelve 2¼-in. steel stays. The tension of the stay bolts is not taken on the threads in the two sheets, but by steel cap nuts which have wide shoulders reset into the tube sheet. An arrangement of baffles in the water box provides four water passes. Expansion of the tubes independently of the shell is provided for by a floating head,

which also is strongly reinforced by steel stays. The tubes are of Admiralty metal and are supported between the tube sheets by cast-iron baffle plates with chamfered holes. A hot well is provided for collection of the condensate.

Combined Synchronous Motor and Magnetic Clutch

A standard synchronous motor combined with a magnetic clutch in a single compact unit has been developed by the Westinghouse Electric & Manufacturing Company. The motor is available in standard ratings from 60 hp. to 600 hp., with larger ratings built as special machines. The over-all dimensions of the new motor are practically the same as those of the standard synchronous motor of the same rating, with the exception of the length, which is from 4 in. to 10 in. greater. This apparatus thus combines high starting torque with synchronous-motor operation in a single unit.

Valves and Fittings

A new line of valves and fittings for the higher range of temperatures and pressures has been placed on the market by the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio. The valve body is drilled out of a solid steel forging by a special method which is said to assure uniformity of wall thickness and practically eliminates unequal internal stresses due to temperature changes as well as being nonporous and capable of withstanding excessive tensile strains. The valve is constructed on the straight-line principle.

In this line of valves a plain ground bevel seat is used with no shoulders or other projections to impede the steam flow, and the tendency toward cutting is minimized to the vanishing point, even when the valve is cracked. The disk surface is slightly spherical, giving a line contact when closed. The steel yoke and bonnet has the same coefficient of expansion as the body. The yoke is drilled for the insertion of a pin which holds the packing nut and gland up while the valve is being repacked. When operating conditions demand, the seat, disk and stem are furnished in monel metal or a special new acid-resisting steel.

Direct-Current Motor

A new line of 40-deg.-rating direct-current motors, type "NA," has been developed by the Louis Allis Company, Milwaukee, Wis. The new line of motors is interchangeable, rating for rating, in all essential dimensions with the Louis Allis polyphase motors. It is said that in this new line improved design and ventilation insure uniform cooling throughout the windings. The bearing chamber is designed to hold an extra quantity of oil. Bearing inspection is made through a removable cover, which, while permitting easy inspection, gives in effect a dust-tight bearing chamber. Elimination of oil trouble is claimed by virtue of a new design incorporated in the bearing.

Continuous Regenerative-Type Air Heater

A heater of the continuous-flow regenerative type which is said to combine the best advantages of recuperation and regeneration has been developed and placed on the market by the Blaw-Knox Company, Pittsburgh. An arrangement of valves and heating chambers in the heater itself permits an alternate passage of air and waste gases in opposite directions over plate-heating elements. The heating elements consist of thin detached steel sheets spaced about ¼ in. apart and arranged vertically in three chambers, giving a large amount of effective heating surface per unit of volume. With the valve arrangement a uniform flow of both air and waste gases is maintained to and from the heater. The leakage is virtually limited to the chamber loss due to reversals and can be kept as low as 2 per cent to 3 per cent.

The counter flow of air and waste gases tends materially to reduce the deposit of dirt on the heating elements. Where necessary soot blowers are installed to facilitate soot removal and cleaning. All parts of the heater as well as the heating elements are readily accessible. With this heater it is practical to preheat air to within 150 deg. F. of the temperature of the incoming waste gases. The heater is applicable to industrial heating furnaces as well as boilers and can be designed for handling waste gases up to 2,000 deg. F. It is manufactured in a large range of sizes capable of heating from 5,000 lb. to 220,000 lb. of air per hour. The Blaw-Knox Company, which is manufacturing the heater, is also marketing it in the general industrial field. The Power Specialty Company, New York City, is marketing this heater in the central-station field.

Engine-Type Alternators

An engine-type alternator of the "flywheel" type has been placed on the market by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. This machine is similar to the "flywheel" type synchronous motor developed by the Ideal company and described and illustrated in the March 7 issue of the ELECTRICAL WORLD. This type of alternator construction creates a self-contained power unit, being an integral part of the machine, occupies less space and does away with any generator foundation and erection. With the same rotor weight the flywheel effect of the "flywheel"-type alternator is said to be nearly twice that of the conventional type of machine. If extra-heavy flywheel effect is desired, the rotor is provided with a double-rim construction. The problem of incorporating the necessary flywheel effect in the alternator rotor is said to be only a question of bearing limitations.

Protective Solutions.—A protective coating in black and colors for preventing the corrosion of iron, steel and other metals, known as the "Quigley Triple A" solutions, has been placed on the market by the Quigley Furnace Specialties Company, Inc., 26 Cortlandt Street, New York. The solutions are also used to waterproof, protect and decorate the surfaces of concrete, brick, stone and wood and can be used on concrete direct without sizing. They are alkali-proof and waterproof and resist the action of acids. They are compounded from coal tar derivatives carefully heat treated and will not crack, chip or peel. It is said that when properly applied they will always reduce and in most cases eliminate corrosion.

Unit Flasher.—A unit type of motor-driven flasher, built in a special motor frame of cast iron and thus self-contained, has been placed on the market by the Reynolds Electric Company, 2650 West Congress Street, Chicago. The flasher mechanism is driven through a train of gears by a standard motor. The flasher is made with one, two or three brushes and will handle a like number of circuits. The brushes ride the contactor drum without movement or vibration, the drum operating on a quick-make-and-break principle, which is a new feature of the construction of this flasher. The unit, which can handle from 400 watts to 800 watts per circuit, is suitable for either outdoor or indoor installation. Suggested applications include its use with electric signs, bulletin boards, window displays, railroad-crossing lights, warning signals.

Molding Compounds.—A molding compound having the properties of flexibility and resiliency has been developed by the General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y. The new material is said to be practically unbreakable even in the thinnest piece, has excellent dielectric strength, very good mechanical strength and takes and retains a mirrorlike polish. The material, which is known as "Star Insulate," can be molded, it is said, with the finest of threads or metal inserts and into almost any shape, thick or thin. It can also be tapped, drilled or sawed almost as readily as hard wood. Two pieces of this material can be cemented together in such a way that the chemical action will prevent their being broken apart. The material, which is also translucent, can be furnished in almost any color.

Ball-Bearing Electric Chain Hoist.—A new ball-bearing electric chain hoist, known as the "model 20-B," has been developed by the Yale & Towne Manufacturing Company, Stamford, Conn. The new hoist is said to embody such features as close headroom, long lift, higher speed, automatic top and bottom limit stops and greater over-all strength and to have unusual factors of safety in the strength of the load-supporting members, being designed to withstand the shock loads so common with this class of equipment. The mechanism is fully inclosed in oil-tight chambers, splash lubrication providing a continuous flow of oil over all gears, pinions and bearings. The equipment is said to be compact and is easily accessible for inspection. Steel-chain containers can be furnished to hold any length of slack chain up to 60 ft., for ½, ¾ and 1-ton hoists and 30 ft. for the 2-ton hoist. These containers are secured to the under frame of the hoist and do not affect the head room.

New Trade Literature

ELECTRIC HEATING ELEMENT.—The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, is distributing a folder covering its "Hotpoint Calrod" heating element, which it uses in its electric ranges, irons, waffle irons, broilers, automatic heaters, etc.

CONCRETE CONSTRUCTION.—"Celite an Admixture for Concrete" is the title of bulletin No. 314 issued by the Celite Products Company, 11 Broadway, New York City, in which it calls attention to the use of "celite" as an admixture in concrete. It contains illustrations of various buildings, tunnels, bridges, etc., where "celite" was used. A partial list of representative jobs where "celite" has been used as an admixture in concrete is included.

PRESSURES BLOWERS AND EXHAUSTERS.—Bulletin No. 1,608 issued by the American Blower Company, Detroit, describes and illustrates the "ABC" type "P" pressure blowers and exhausters. It contains tables of capacities for average application to forges and furnaces and for cupola service. The bulletin also describes the "ABC" special type "P" pressure blowers.

DATA FOR SELLING FANS.—"Making Sure of Fan Sales in 1926" is the title of a booklet issued by the Robbins & Myers Company, Springfield, Ohio, which outlines a plan for selling the "R. & M." fans all the year around. It contains specimens of folders and booklets for distribution, photographic display signs, etc.

STOKER.—The Riley Stoker Corporation, 9 Neponset Street, Worcester, Mass., has issued a booklet covering the "Lateral Retort" underfeed stoker, which is applicable to all types of boilers. A number of drawings are given showing various sections of the stoker, and numerous illustrations of typical installations are included.

ELECTRIC FURNACES.—The Pittsburgh Electric Furnace Company, Thirty-second and Putney Streets, Pittsburgh, is distributing bulletin No. 1, describing and illustrating its "Lectromelt" furnaces, which may be operated with direct or indirect arc, for college and research laboratories.

HOUSEHOLD APPLIANCES.—The Manning & Bowman Company, Meriden, Conn., is distributing catalog No. 82, covering the "MB" electric household appliances and other products. The company is also distributing price list No. 228.

BOILER-FEED WATER.—"Raw-Water Distilling Plants for Producing Distilled Boiler-Feed Make-Up Water" is the title of a booklet issued by the Griscom-Russell Company, 285 Madison Avenue, New York City, in which it calls attention to the benefits secured by the use of pure feed water, associating the evaporator plant with the power plant, heat balance, the benefit of heat analysis, etc. It also contains a description of the early practice of supplying distilled boiler feed and of recent practice. A list of organizations which have adopted the system described in this bulletin is included.

FANS.—The Robbins & Myers Company, Springfield, Ohio, has issued its domestic catalog No. 1,265 of the "R. & M." electric fans for alternating-current and direct-current circuits, non-oscillating, oscillating, ceiling and ventilating fans. It contains tables giving the dimensions, voltage, cycles, etc., of the various types of fans and instructions for mounting same.

GRAPHIC INSTRUMENTS.—The Esterline-Angus Company, Indianapolis, Ind., is distributing bulletin No. 1,125 in which it describes the use of graphic instruments in setting circuit breaker and overload relays. It contains four charts illustrating the setting of overload circuit breakers, the adjustment of time-limit relays, setting of current-limit relays on controllers and the protection of induction motors against overload.

INDUSTRIAL LIGHTING.—"Modern Retailing Success" is the title of booklet No. 444, issued by the Holophane Glass Company, 342 Madison Avenue, New York City, describing and illustrating its methods of retailing its illuminating products. It contains an article entitled "How to Control Light" and a number of illustrations showing various typical installations of Holophane reflector refractors for show-window lighting, department stores, etc.

ELECTRICAL SUPPLIES.—The Graybar Electric Company, successor to the supply department of the Western Electric Company, 100 East Forty-second Street, New York City, is distributing its electrical supply year book for 1926-27, covering its complete products, including household appliances, power equipment, switchboards, intercommunicating systems, wiring devices, line-construction material, circuit breakers, wire and cable, switches and panelboards, insulators, lighting equipment, poles, etc.

MOTOR AND CONTROL EQUIPMENT.—Bulletin GEA-202 issued by the General Electric Company, Schenectady, N. Y., covers its single, motor and control equipment for job presses. The bulletin contains a guide to the selection of the proper motor for job presses.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FRANKLIN, MASS.—The Union Light & Power Company plans extensions and improvements in its system.

HAVERHILL, MASS.—Plans are under way for the erection of a transmission line to connect the systems of the Haverhill Electric Company and the Newburyport Gas & Electric Company, recently consolidated.

NORTH ABINGTON, MASS.—Plans are under way by the Edison Electric Light Company of Brockton and the Abington & Rockland Electric Light & Power Company for the erection of a high-tesion transmission line from the plants at Brockton and North Abington to Hanover.

Middle Atlantic States

ALFRED, N. Y.—The Village Board has contracted with the New York Central Electric Corporation, Perry, to install a street-lighting system in the business section of the town.

BUFFALO, N. Y.—Plans for rebuilding the plant of the Modern Laundry Company, recently destroyed by fire, with a loss of about $160,000, include a power plant.

CHURCHVILLE, N. Y.—The installation of an ornamental lighting system in the business district is under consideration by the Village Trustees.

GLENDALE, N. Y.—The Pequot Manufacturing Company, Long Island City, plans to install electric power equipment at its proposed local corrugated paper box plant, to cost about $500,000; also, in a paper mill now being considered on an adjoining site to cost about $500,000.

LACKAWANNA, N. Y.—Electric power equipment will be installed in the proposed addition to be erected at the local mill of the Bethlehem (Pa.) Steel Company, to cost about $1,000,000. W. A. James is chief engineer.

MOUNT MORRIS, N. Y.—Plans for rebuilding the mill of the Gilbraith Milling Company, recently destroyed by fire, with a loss of about $70,000, include a power plant.

NEW YORK, N. Y.—Plans are under way by the Bronx Gas & Electric Company for an addition to its power plant on Zerega Avenue, Bronx, including improvements in the present station. J. F. Hunter, Irving Place and Fifteenth Street, is architect.

OSWEGO, N. Y.—Application has been made by the Oswego River Power Corporation for permission to acquire the property of the People's Gas & Electric Company. The petition states that the company proposes to make new developments in Oswego and to connect the transmission lines of the Oswego company with the lines of the Northern New York Utilities, Inc., of Watertown.

PIERMONT, N. Y.—Electric power equipment will be installed in the proposed local paper box factory to be erected by the Robert Gair Company, 50 Washington Street, Brooklyn, N. Y., to cost about $300,000. William Higginson, 15 Park Row, New York, is architect.

SHERBURNE, N. Y.—The village of Sherburne has petitioned for permission to extend the transmission lines of the municipal electric plant, a distance of about 1½ miles, to furnish electricity in the hamlet of Columbus.

ABSECON, N. J.—The installation of an ornamental lighting system on Absecon Boulevard, covering a distance of 3 miles, is under consideration by the Council.

DEAL, N. J.—The Eastern New Jersey Power Company, Asbury Park, contemplates installing underground conduits through Deal, at a cost of about $30,000.

SOUTH AMBOY, N. J.—The Board of Public Works has authorized plans for the complete electrification of the municipal water plant.

ORBISONIA, PA.—The Penn Central Light & Power Company, Altoona, has submitted a proposal to the towns of Orbisonia and Rockhill Furnace offering to erect a transmission line from Three Springs to supply electricity in both towns. The cost of the proposed line is estimated at about $40,000.

ORRTANNA, PA.—The General Gas & Electric Corporation, 50 Pine Street, New York, which has acquired the property of the Orrtanna Electric Light & Power Company, through its Pennsylvania-New Jersey system, plans extensions in the transmission lines in this section.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Electric Company for two new substations to be erected on Kings Avenue, near Tioga Street, and at Kensington Avenue and J Street, to cost about $100,000. John T. Windrim, Commonwealth Building, is architect.

FAIRMONT, W. VA.—Plans for rebuilding the plant of the Hygia Manufacturing Company, recently destroyed by fire, with a loss of about $50,000, include a power plant.

KENOVA, W. VA.—Plans are under way by the Consolidated Power & Light Company, Huntington, for extensions and improvements in its local electric power plant, including the installation of a 30,000 kva. turbo-generator, to cost about $1,000,000.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Feb. 23, for one 80 to 100 hp. Diesel engine (Panama Circular 1722).

WASHINGTON, D. C.—Bids will be received at the office of the United States Engineer Office, 1,068 Navy Department Building, Washington, D. C., until March 1, for furnishing and installing an electric freight elevator for the water supply project for the District of Columbia.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Feb. 19, for turbo-generating sets for the Mare Island and Brooklyn navy yards (Schedule 900-349).

WASHINGTON, D. C.—Bids will be received by the General Supply Committee, Treasury Department, Washington, until March 3, for annual supply of desk fans, ceiling fans, adjustable fixtures, conduit and fittings, flexible cord, flashlights, wire, etc. (Class 6).

North Central States

IONIA, MICH.—The State Administrative Board, Lansing, has authorized an appropriation of $26,000, for extension and improvements in the power plant at the local state reformatory.

PARIS, MICH.—Plans are being prepared by the Muskegon (Mich.) Light & Power Company for the construction of a dam and power plant on the Muskegon River, near Paris, to develop 4,500 kw.

CLEVELAND, OHIO.—The 1926 budget of the Cleveland Electric Illuminating Company provides for an expenditure of $10,000,000, of which a large part will be used for completion of the Avon power station. Extensions and improvements to its distribution system, etc., are also contemplated.

DAYTON, OHIO.—Extensions to its distributing system and the erection of new substations, to cost about $1,071,800, during 1926, are contemplated by the Dayton Power & Light Company.

GALLIPOLIS, OHIO.—Bids will be received by the Department of Welfare, Ninth and Oak Streets, Columbus, until Feb. 18, for a power house for the local State Institution for Epileptics, to cost about $65,000. H. H. Briggs, Ohio Hartman Building, Columbus.

WILLOUGHBY, OHIO.—The City Ice & Fuel Company, 1,935 Euclid Avenue, Cleveland, plans to build an ice plant here, to cost about $85,000.

YOUNGSTOWN, OHIO.—Improvements and extensions calling for an expenditure of about $4,700,000 during 1926 are contemplated by the Pennsylvania-Ohio Electric Company. The work will include new station construction, new transmission lines and extensions to distribution system, etc.

LOUISVILLE, KY.—The Kentucky Utilities Company, Louisville, has been granted franchises in Barlow and La Centre to install electric distribution systems.

MARION, KY.—The Kentucky Utilities Company, Louisville, which has acquired the electric system of the Marion Electric Light, Ice & Water Company, plans to erect a 20-mile transmission line from Marion to Princeton to connect with the local plant with its transmission system.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company, recently taken over by the Central Indiana Power Company, is planning to build an addition to its power plant on West Tenth Street, to increase the output from 20,000 to 50,000 kw., to cost about $800,000. Improvemnts are also contemplated at the step-down station at Lenore.

SCOTTSBURG, IND.—The Interstate Public Service Company, Indianapolis, contemplates rebuilding its local machine and mechanical shop, recently damaged by fire, with loss of about $40,000.

JACKSONVILLE, ILL.—Plans have been prepared for extensions to the municipal electric plant, to include the installation of two 500-kw. turbo-generators, and condensers, stokers, poles, lines, etc., and construction of reservoir. The cost is estimated at 100,000. H. L. Caldwell, Jacksonville, is engineer.

TELL CITY, IND.—The municipal electric and water plants have been acquired by the Ohio River Power Company, Cannelton, a subsidiary of the Kentucky-Tennessee Light & Power Company, Bowling Green. These properties are to be connected by a transmission line with the plant at Cannelton. The company has been granted permission to build a transmission line crossing the Ohio River at Hawesville to make connection with the six plants acquired in Kentucky.

VENICE, ILL.—A site has been acquired by the Illinois Power & Light Corporation, Chicago, adjacent to its local plant, on which it proposes to build an addition to its power plant, to cost about $5,000,000. The equipment will include a 30,000-kw. turbine and three 1,500-hp. boilers. The new plant will supply energy for the transmission lines of the company between Peoria and Cairo.

ARGONNE, WIS.—The Wisconsin Valley Electric Company, Wausau, has submitted a proposal to the Town Board offering to extend its high-tension transmission line to Argonne, providing the town would appropriate $3,000 toward the expense of building the proposed line.

BURLINGTON, WIS.—The City Council is considering a proposal submitted by the Wisconsin Gas & Electric Company for installing a new street-lighting system. The plans provide for nine 100-cp., Sixty 250-cp., seventy 400-cp., and twenty-nine 600-cp. lamps.

KILBOURN, WIS.—Plans have been adopted by the Southern Wisconsin Power Company, Madison, to replace the 2,500-hp. 25-cycle hydro-electric generating unit in the local plant with a 3,150-hp., 60-cycle unit. Eventually all the units will be changed to 60 cycles.

OCONTO, WIS.—The Wisconsin Public Service Corporation, Green Bay, contemplates improvements to its local system including the installation of new regulators and switching equipment, and the removal of all poles and lines to alleys in the commercial and residential districts.

OSHKOSH, WIS.—The Central Wisconsin Power Company plans to erect a transmission line to Clintonville, Berling and Marion for local service.

TOMAHAWK, WIS.—The Wisconsin Valley Improvement Company has applied for permission to build a dam on the Tomahawk River, 21 miles north of Tomahawk.

FRAZEE, MINN.—The Otter Tail Power Company, Fergus Falls, plans to build a power plant in Frazee, to cost about $15,000 early in the spring.

IOWA CITY, IOWA.—Bids will be received by the Iowa State Board of Education, until Feb. 16, for construction of power and boiler house, etc., to cost about $125,000. Proudfoot, Rawson & Souer, Hubbell Building, Des Moines, are architects. W. H. Gemmil is secretary.

MAQUOKETA, IOWA.—Permission has been granted the Eastern Iowa Power Company to build a dam across the Maquoketa River.

OELWEIN, IOWA.—The Inter-State Power Company, 327 La Salle Street, Chicago, contemplates extensions to its transmission lines in Winneshiek County.

PAULLINA, IOWA.—Permission has been granted the Northwestern Light & Power Company, Cedar Rapids, to erect a transmission line from Paullina to Granville.

KANSAS CITY, MO.—The Washburn-Crosby Company, Minneapolis, plans to install electric power equipment in its local feed mill on Guinotte Avenue, to cost about $250,000.

KENNETT, MO.—The Arkansas-Missouri Power Company, Blytheville, Ark., plans to build a large ice plant here and distribute ice in neighboring rural districts.

SARCOXIE, MO.—The Public Service Commission has approved the sale of the properties of the Southwest Electric Light & Milling Company, operating in Sarcoxie, La Russel and Bowers Mills, to the Ozark Utilities Company, Bolivar. The new owner plans to rebuild and extend the properties.

STEWARTSVILLE, MO.—The St. Joseph Transmission Company, Oregon, which has acquired the local plant, plans to extend its transmission lines into the rural districts to supply electricity to farmers near Stewartsville.

ANETA, N. D.—The Otter Tail Power Company, Fergus Falls, Minn., which has acquired the local electric plant, plans to erect a transmission line to connect the local system. It also purposes to construct transmission lines to connect Lankin, Adams, Minto, Ardock and Walhalla, N. D.

BELLE FOURCHE, S. D.—The Tri-State Milling Company, Belle Fourche, plans to erect a transmission line from Belle Fourche to Newell, Sturgis and vicinity, for light and power service.

HARROLD, S. D.—Steps have been taken by the residents of Harrold to secure an electric light plant. It has not been decided whether to build a municipal plant or to grant a franchise to a private company.

SEWARD, NEB.—The Blue River Power Company plans to extend transmission lines from Bellwood to several districts in Butler County.

LYONS, KAN.—The American Salt & Coal Company, Waldheim Building, Kansas City, Mo., plans to install electric power euipment in the proposed evaporating plant at its local properties, to cost about $300,000.

Southern States

HIGHLANDS, N. C.—Application has been made to the Federal Power Commission by Zebulon Weaver, representing the citizens of Highlands for a permit to locate the proposed municipal electric plant on the Cullasaja River.

SCOTLAND NECK, N. C.—The Virginia Electric & Power Company, Richmond, contemplates extensions in transmission lines in this section, to cost about $50,000.

COLUMBIA, S. C.—The Broad River Power Company has applied to the City Council for permission to erect a 13,000-volt transmission line around the city to serve Wales Gardens, Shandon and North Columbia, suburbs of Columbia.

COLUMBUS, GA.—Plans for the proposed local plant of the Henrietta Pottery Company, recently organized, include a power plant. J. Dudley Eason is interested in the project.

LINCOLNTON, GA.—The Augusta-Aiken Power Company, Augusta, is planning to erect a transmission line to Lincolnton for local service.

NEWNAN, GA.—The City Council is considering improvements to the municipal electric system, to cost about $18,000.

THOMASVILLE, GA.—Extensions and improvements to the municipal electric light and water plant, to cost about $50,000 are contemplated by the City Council.

CORAL GABLES, FLA.—The construction of a cold storage and ice plant, to cost about $1,400,000, at Greco Avenue and Le Jeune Court, is under consideration by the Florida East Utilities, Miami.

FORT PIERCE, FLA.—The installation of an ornamental lighting system is under consideration.

LAKE WORTH, FLA.—The Florida Power & Light Company, Miami, contemplates building a local steam-operated electric plant to cost about $250,000. It also plans to erect a transmission line to Englewood and vicinity.

PALM BEACH, FLA.—The Council is considering calling an election to vote on the proposal to issue $2,000,000 in bonds for municipal improvements, of which $500,000 will be used for improvements to the electric lighting system, including the installation of ornamental lamps.

PENSACOLA, FLA.—The Gulf Power Company, a subsidiary of the Alabama Power Company, Birmingham, has applied to the County Commissioners for permission to erect transmission lines in Pensacola.

PARIS, TENN.—Surveys are being made by the Kentucky-Tennessee Light & Power Company, Bowling Green, Ky., which has acquired the local plant, for the erection of a 33,000-volt transmission line from Paris to Gleason. A substation will be erected which will supply power to Henry and Como. This line, it is understood, will be extended to Mayfield, and will furnish electricity to Parlock, Whitlock, Hazel and Murray and other towns in Calloway and Graves Counties.

SPENCER, TENN.—J. V. Wigle, Spencer, and associates, have applied for a franchise to construct an electric plant in Spencer, to cost about $25,000.

MOORESVILLE, ALA.—The Alabama Power Company, Birmingham, plans to build a local substation for service here and at Belle Mina.

MONETTE, ARK.—The local plant of the Arkansas-Missouri Light & Power Company, Blytheville, was recently destroyed by fire, causing a loss of about $28,000.

ADDINGTON, OKLA.—The Southwestern Light & Power Company, Lawton, has been granted a franchise to supply electricity in Addington.

FARGO, OKLA.—Bonds to the amount of $22,000 have been voted for the erection of a transmission line between Fargo and Woodward and a distribution system in Fargo. H. G. Olmstead, Oklahoma City, is engineer.

RAVIA, OKLA.—Plans are under way by the Oklahoma Gas & Electric Company, 112 North Broadway, Oklahoma City, for the erection of a local distribution system and a 9-mile transmission line between Ravia and Troy, to cost about $25,000. The Byllesby Engineering Company, 231 South La Salle Street, Chicago, is engineer.

MARSHALL, TEX.—Extensions and improvements are contemplated by the East Texas Public Service Company involving an expenditure of about $1,250,000 during 1926. The work will include the erection of 125 miles of high-tension transmission lines and increasing the voltage of the line from Marshall to Grand Saline from 33,000 to 60,000.

Pacific and Mountain States

CHEHALIS, WASH.—Plans are under way by the Backus-Brooks Company, Minneapolis, Minn., for a proposed hydroelectric 20,000-hp. plant on the Cowlitz River, in Lewis County, including a transmission line for service at a proposed pulp and paper mill. The cost of the entire project is estimated at $10,000,000.

RAYMOND, WASH.—Application has been filed by the Willapa Electric Company for water rights on the North River at Canto, about 8 miles from Raymond, for a hydro-electric plant. The plans call for a development of 10,000 hp., to cost about $1,540,000.

BURLINGAME, CAL.—The Board of City Trustees contemplates the installation of an improved lighting system on Burlingame Avenue.

LONG BEACH, CAL.—Plans are under way by H. B. King and associates, Security Building, for an ice manufacturing plant and ice and cold storage plant, east of the municipal docks, to cost about $150,000. Fisher, Lake & Travers, 801 Edwards and Wildy Building, Los Angeles, are engineers.

MARYSVILLE, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to build a substation, near Barry Street, to cost about $60,000.

PALO ALTO, CAL.—The City Council is considering the installation of an ornamental lighting system in the Mayfield District.

REDWOOD CITY, CAL.—The Plant Rubber & Asbestos Works, 537 Brannan Street, San Francisco, plans to install electric power equipment in connection with the proposed rebuilding of its plant recently damaged by fire with loss of about $200,000.

SAN FRANCISCO, CAL.—The Feather River Power Company, Hobart Building, has applied for permission to use waters from Grizzley Creek, Pebble Creek, and other streams in Plumas County, all tribu-

taries of the North Fork of the Feather River, for a proposed hydroelectric plant to develop about 10,000 hp. The cost of the project is estimated at $5,000,000.

VENTURA, CAL.—Plans have been filed by the Southern California Edison Company, Los Angeles, for the erection of a substation on West Santa Clara Street.

VISALIA, CAL.—The Southern California Edison Company, Los Angeles, plans extensions during 1926, to cost about $3,000,000, including extensions in transmission lines in Tulare County, improvements and extensions in hydroelectric plants on the Tule and Kaweah Rivers, a number of substations, etc.

RENO, NEV.—The City Council plans extensions in the street-lighting system on South Virginia, West Second, and other streets. Harry Chism is city engineer.

RENO, NEV.—Electric power equipment will be installed in the proposed local ice plant to be erected by the Union Ice Company, 354 Pine Street, San Francisco, to cost about $100,000.

SANTA FE, N. M.—Plans for the proposed milling plant to be built by the American Metal Company, 61 Broadway, New York, at its local mining properties, to cost about $1,000,000, include a 3,500-kw. power plant.

Canada

VANCOUVER, B. C.—The installation of ornamental lamp standards, etc., on various streets, to cost about $500,000, is under consideration by the City Council. C. H. Fletcher, City Hall, is engineer.

LISTOWEL, ONT.—The Listowel Public Utilities Commission is considering the installation of a gas engine in the municipal electric plant.

MONTREAL, QUE.—A bill has been introduced to the Quebec Legislature providing for a water power development of 50,000 hp. by the Montreal Island Power Company, on the Rivière des Prairies. It is proposed to build a dam reaching from Cedar Island to a point on the north shore.

JONQUIERES, QUE.—The installation of a new fire-alarm system, to cost about $40,000, is under consideration. J. W. Smith, c/o Northern Electric Company, Montreal, is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 5, 1926)

1,568,701. ELECTRON DISCHARGE APPARATUS; J. C. Warner, Schenectady, N. Y. App. filed March 5, 1925. Having at least four electrodes.

1,568,702. GRAPHIC INTEGRATING RECORDER; H. E. Warren, Ashland, Mass. App. filed Jan. 4, 1922. Will not only permanently record the approximate instantaneous values of the quantity being measured, but will show the accumulated variation plus or minus from normal value as well as the rate of variation.

1,568,703. DEMAND RECORDER; H. E. Warren, Ashland, Mass. App. filed March 21, 1924. Graphic type, the record obtained being a dotted-line curve of integrated demand over equal time intervals.

1,568,710. VOLTAGE-REGULATING SYSTEM; T. F. Barton, Schenectady, N. Y. App. filed March 30, 1923. For synchronous booster converters. The excitation of the booster is automatically controlled so that it is proportional to the power supplied by the converter and has a direction which depends upon the direction of the output of the converter, thus causing the booster to limit the load current supplied by or to the converter.

1,568,724. PRESSURE-RESPONSIVE INSTRUMENT FOR FLOW METERS AND THE LIKE; F. P. Cox, Lynn, Mass. App. filed March 3, 1923. Instrument responsive to pressure or pressure difference and used to indicate, indicate and record, or indicate, record and integrate, a pressure or pressure difference.

1,568,735. MOTOR CONTROLLER; J. A. Hepperlen, East Orange, N. J. App. filed Oct. 9, 1922. Reversing-control system for alternating-current motors, and in particular for operating a two-phase motor in the forward and reverse direction from a single-phase source of supply.

1,568,748. SWITCH ASSEMBLY; G. S. Leddick, Schenectady, N. Y. App. filed July 13, 1925. As motor-starting compensators which comprise an auto-transformer, switch mechanism or contactors for establishing the motor connections, and devices such as relays and the like for controlling the switch mechanism.

1,568,760. ELECTROMAGNETIC RELAY; T. G. Martin, Chicago, Ill. App. filed Dec. 9, 1920. Known as gang or multiple-contact relays.

1,568,774. BRUSH; T. J. Scofield, Jackson, Mich. App. filed May 17, 1923. Lubricating type.

1,568,783. LOOM LOCK; R. D. Thompson, Toledo, Ohio. App. filed Aug. 27, 1923. For outlet box.

1,568,799. LOOM LOCK; P. B. Clark, Columbus, Ohio. App. filed March 17, 1924. For outlet box.

1,568,815. ELECTRIC LAMP SOCKET; New York, N. Y. App. filed March 16, 1922. For miniature lamps used for decorative purposes.

1,568,848. STARTING SWITCH; R. Kellendorfer, Munich, Germany. App. filed Oct. 5, 1923. A rocking casing containing a carbon resistance or the like, said casing and co-operating conduits containing an electricity-conducting liquid, such as mercury, which rises on the resistance when the casing is moved to a predetermined position and thus gradually cuts out the resistance or decreases the latter until the liquid reaches a conductor forming part of the switch.

1,568,929. ELECTRIC LIGHTING FIXTURE; W. Symmes, San Francisco, Cal. App. filed Oct. 20, 1924. Ceiling fixture having a bowl or acorn of non-transparent translucent material which is illuminated by an electric lamp contained within the fixture. The filament of the electric lamp is so positioned with respect to the bowl that the bowl is evenly illuminated over its entire surface.

1,568,947. PORTABLE ELECTRIC LAMP; F. B. Little, Chicago, Ill. App. filed Nov. 15, 1920. Having an electromagnetic base which serves as a means for self-attachment to a magnetically susceptible support, with a switch to open the circuit conveniently through the magnet to release the lamp. The lamp is also provided with an attachment by means of which small iron or steel objects that may have fallen into inaccessible places may be picked up and conveniently removed.

(Issued Jan. 12, 1926)

1,568,955. MOLDING MATERIAL; H. Buchholz, Berlin, Germany. App. filed Nov. 14, 1923. Having the range of use of vulcanized rubber molded from a heat-plasticized composition containing acetyl cellulose, powdered glass, bone meal and magnesite.

1,568,970. INTEGRATING METER; E. H. Freeman, Wilmette, Ill. App. filed April 15, 1920. Comprising a rotatable element in which two or more torques are developed, one or more producing rotation and one or more retarding rotation. These torques are produced electromagnetically, and the number of revolutions of the rotatable element is an integration with respect to time of some function of the conductances or of the admittances of the electrical circuits in which the meter is connected.

1,568,995. ATTACHMENT PLUG; R. B. Benjamin, Chicago, Ill. App. filed April 17, 1922. Separable, in which the cap portion is provided with an extension handle for facilitating the insertion of the plug in places which are difficult of access with the ordinary attachment plug.

1,569,018. ATTACHMENT PLUG; C. L. Hopkins, River Forest, Ill., and C. E. Warner, Berwyn, Ill. App. filed Jan. 12, 1922. Swivel-shell attachment plug with means for facilitating insertion and removal of the plug with respect to the socket.

1,569,042. POTENTIOMETER; D. H. Sheriff, Jr., Kansas City, Mo. App. filed March 5, 1923. By the use of which a plurality of circuits may be controlled from one unit and in which the condensers for the several circuits are contained or embodied in the instrument itself, thus making a single unit of the condenser and potentiometer proper.

1,569,051. SAFETY SWITCH BOX; D. T. Wadsworth, Cold Springs, Ky. App. filed Feb. 11, 1925. Wherein the switch mechanism and lead-in terminals are normally retained within a closed and sealed compartment, while the fuses and fuse sockets are mounted in a separate compartment to which access may be had through an aperture controlled by a sliding panel only when the switch is disconnected from the lead-in lines or source of power.

1,569,069. RAIL BOND; J. F. Brown, Lookout, Ky. App. filed May 2, 1922. Comprising a pair of sections having their outer ends secured to the rail ends and their inner ends detachably secured together, so that when the rails are moved these detachable connected ends are separated, and then rejoined when the rails are again set up in their new location.

1,569,095. BODY OF HIGH ELECTRON AND LIGHT EMISSION AND PROCESS OF MAKING THE SAME; C. A. Laise, Toledo, Ohio. App. filed Nov. 21, 1923. Filamentary bodies having high electron and light emission qualities when raised to incandescence by passing a current through the same, and particularly suitable for use in radio bulbs and incandescent electric lamps, also a process for making such filamentary bodies.

1,569,102. IMMERSION HEATER; A. A. Warner, New Britain, Conn. App. filed Nov. 6, 1923. An element for enabling the heater to stand upright and for elevating the heated end from a table or the like on which the heater may be placed.

1,569,127. ELECTRIC WELDING MECHANISM; J. W. Holt, Cleveland, Ohio. App. filed Oct. 27, 1921. For butt-welding the edges of performed metal tubes and providing an improved support for the electrode rolls; also having an automatic arrangement whereby the contacting pressure of such rolls may be preserved as they wear away and require to be adjusted toward the work.

1,569,147. MEANS FOR PREVENTING OVERHEATING OF ELECTRICALLY HEATED APPLIANCES; A. T. Smith, Winsted, Conn. App. filed Feb. 5, 1925. Using a thermostatic element to short-circuit the line through a fuse or circuit breaker.

1,569,200. TIME SWITCH; D. L. Parkhurst, Washington, D. C. App. filed Nov. 1, 1924 (granted under the act of March 3, 1883). For signaling lamps or the like.

1,569,216. ELECTRIC LIGHT; C. W. Dake, Chicago, Ill. App. filed Feb. 23, 1923. For use especially with locomotive electric headlights and similar purposes where an incandescent electric light is used as the source for an illuminating or searchlight ray associated with a parabolic reflector. A comparatively large portion of the filament is located on or immediately adjacent to and surrounding the focal axis and projects both in front of and behind the focal point. The remainder of the filament is located in the plane perpendicular to this axis and passing through the focal point.

1,569,218. ELECTRIC MACHINE; C. W. Dake, Chicago, Ill. App. filed Dec. 10, 1923. Wherein the laminated pole pieces may be continuous throughout the magnetic circuit, and where there will be a minimum of reluctance; a built-up preassembled pole-piece unit.

1,569,241. ELECTRICALLY HEATED DEVICE; J. F. Smart, New Britain, Conn. App. filed Aug. 11, 1923. Iron having a thermostat located in a centrally disposed recess in the sole plate.

1,569,255. INDICATING DEVICE; A. Block, San Francisco, Cal. App. filed June 12, 1922. Which will not only visibly indicate the number of calls entered but also visibly indicate the order in which they are received.

1,569,299. OPEN-POTENTIAL-CIRCUIT DETECTOR; E. F. Preston, Mason City, Iowa. App. filed Jan. 13, 1922. The combination with any type or style of electric meter of means for detaching or indicating when one or more of the circuits of the potential coils are opened for any cause whatever, in order that the defect may be promptly noticed by the meter reader.

1,569,362. CONTROL SYSTEM; A. D. Ferguson, Oldham, England. App. filed Nov. 12, 1923. Electric traction and like systems wherein the acceleration of the motor or motors is automatically effected rheostatically with or without series parallel and other control, either by means of a multiple position main accelerating controller which is operated automatically under the control of a control drum driven by the spindle of the main controller, or by means of a plurality of contactors controlled by a controller drum which has mounted on its spindle a sequence switch, in either case a current-limit switch being used to delay the automatic acceleration of the motor or motors unless or until the current drawn thereby is below a predetermined safe limit.

1,569,364. ELECTRIC RELAY; B. E. Getchell, Plainville, Conn. App. filed Oct. 18, 1923. Overload relay made in cartridge form similar to a fuse, and having its rating permanently adjusted when manufactured so that it cannot be tampered with.